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The Electrical Industry's Weekly Magazine

March 16, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication

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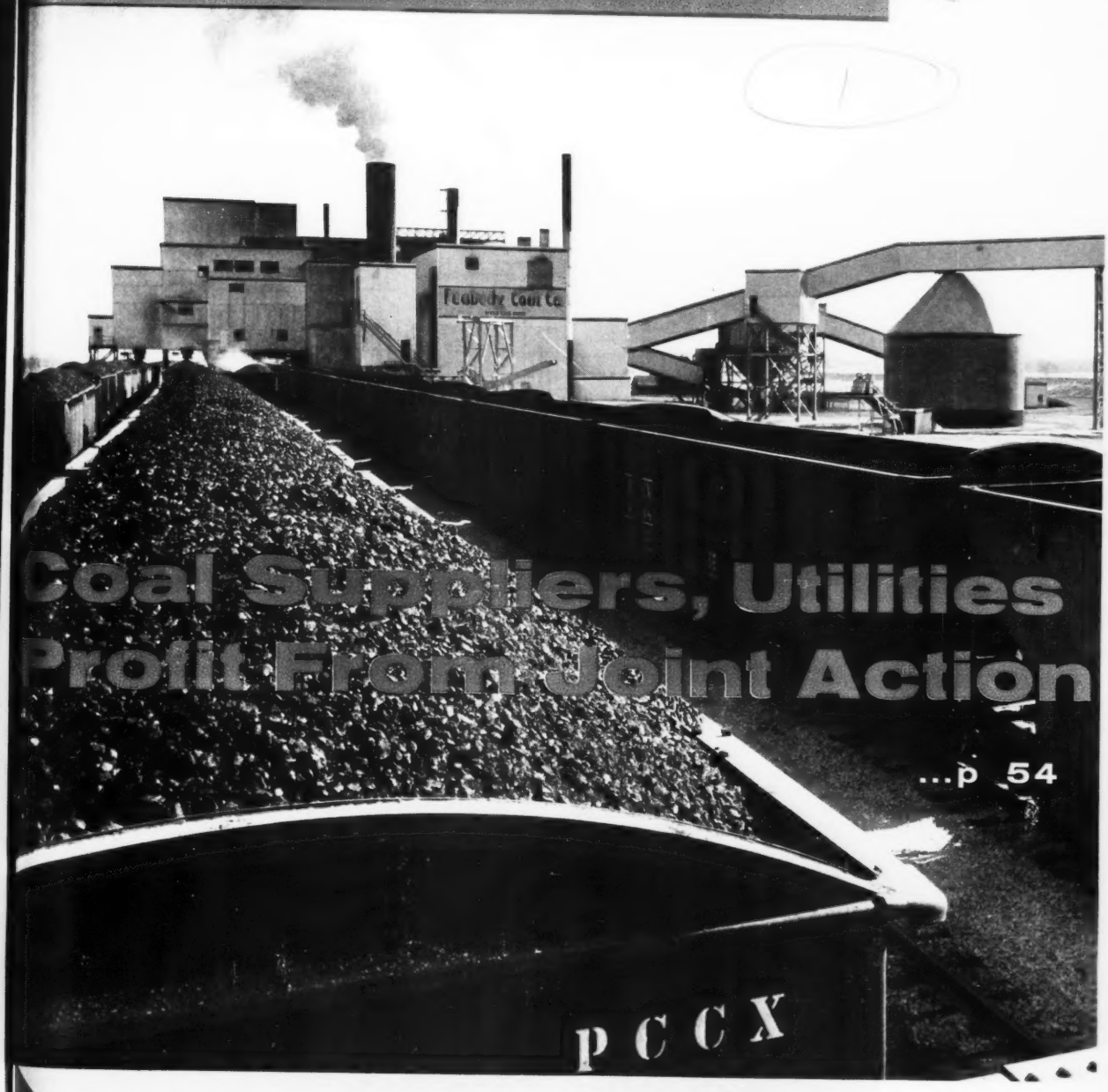

Coal Suppliers, Utilities Profit From Joint Action

...p 54

Bids for Rate Increases Are Running into Roadblocks . . . p 4

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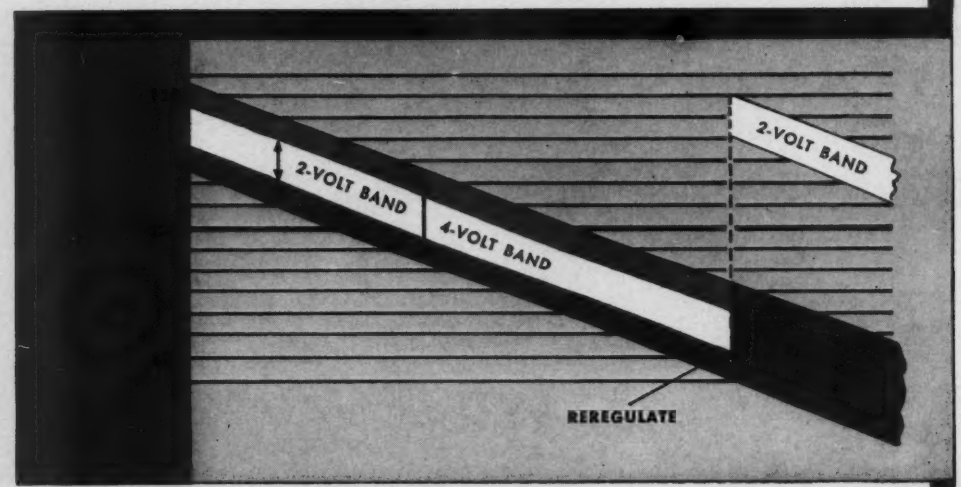
ALLIS-CHALMERS — 25 years of 5/8% Regulator Leadership

Losing revenue?



NATIONAL ELECTRICAL WEEK
FEBRUARY 8-14, 1959

Here are 4 steps to increased revenue!

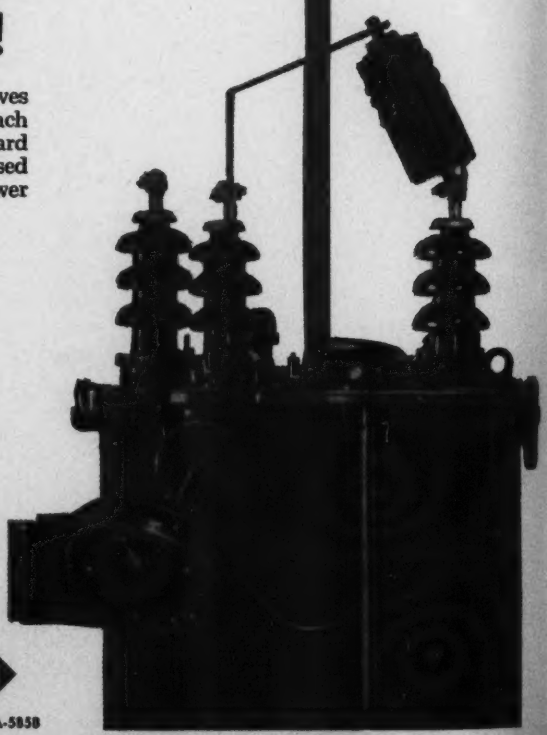
"Engineered regulation" provides added revenue — improves service while cutting regulation cost as much as 50%. Each single volt increase in average voltage on a feeder (toward the optimum) means $1 per customer per year increased revenue. At the same time "engineered regulation" is lower cost regulation.

Four basic steps are:

1. **Cut band width to two volts.**
2. **Reregulate feeders.**
3. **Use low-cost 5/8% step regulators.**
4. **Engineer to *fully* utilize *Vari-Amp*.**

Allis-Chalmers leadership and engineering experience are ready to help you work out a four-step regulator program.

Contact your nearby Allis-Chalmers office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Originators of 5/8% Step Regulators

ALLIS-CHALMERS

Vari-Amp is an Allis-Chalmers trademark.

A-5858

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Cooperation Key to Economical Coal Supply

Assured market gives supplier opportunity to cut mining, transportation costs and pass on savings.....p 54

HEATING AND COOLING

Heat Pump Good Bet for Adding Load

Reid Gardner, Southern Nevada Power Co

Where climate is favorable and kwhr use is above national average, heating-cooling device proves out.....p 62

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Plant Voltage Dips Can Be Alleviated

Bruce G. Bailey, Allis-Chalmers Mfg. Co

Study of voltage profile of system is first step in solution of dip problem in an industrial plant.....p 56

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Speeds, Saves on Transmission Planning

James A. Frank, American Air Surveys, Inc

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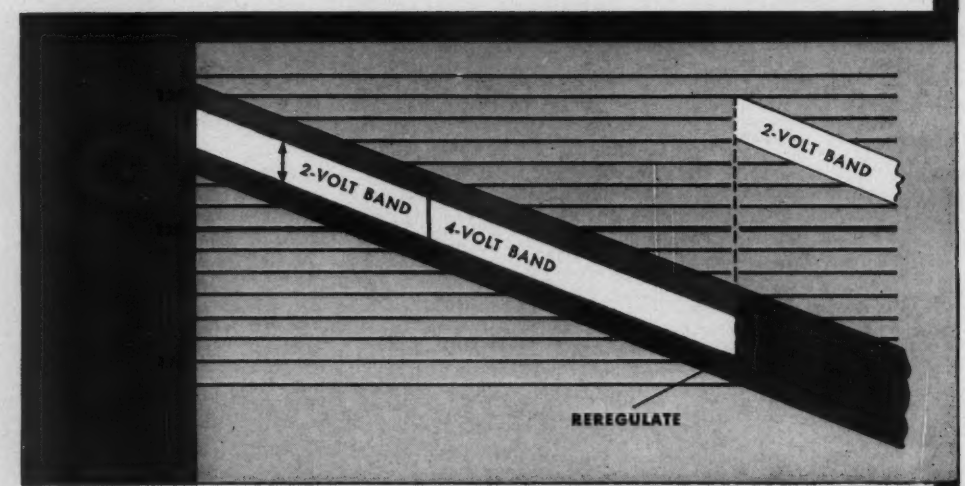

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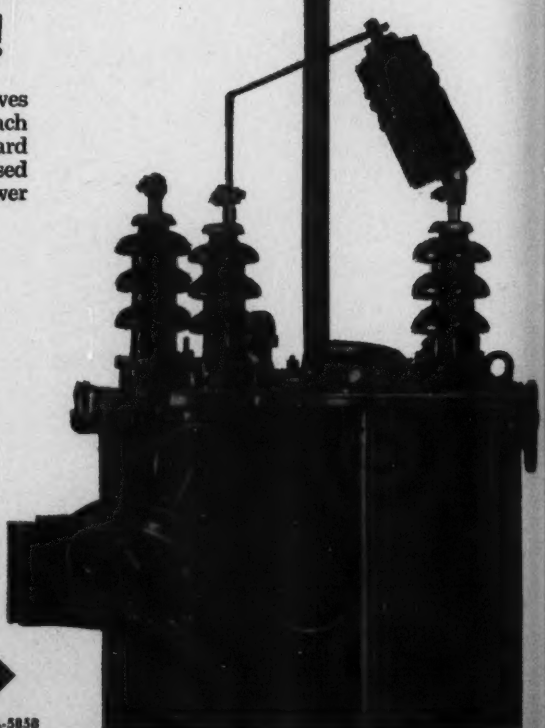

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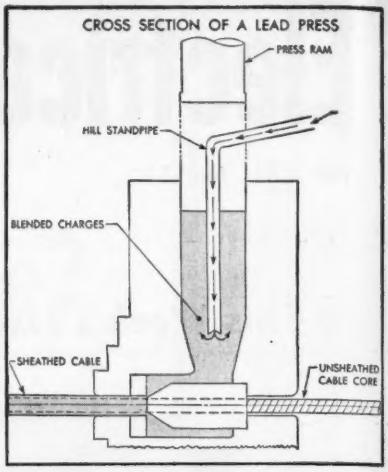
ADVERTISEMENT

Thorough Blending of Successive Lead Press Charges is Essential to Manufacturing Structurally Sound Paper Cable Sheaths

N. A. Zamborsky
Manager-Process Engineering

The Stabilized Lead used in the manufacture of Okonite paper cable sheaths is fed into lead presses by Okonite's Hill Standpipe Method. This permits successive charges to be fed into the press by "bottom-filling and mixing" —blending in *from beneath* the surface of the charge that is being extruded. It assures uniform knitting together of lead charges . . . essential to the manufacture of structurally sound sheaths. It prevents the manufacture of structurally inferior sheaths . . . sheaths that are prone to crack because defects have actually been manufactured into them. These defects occur when successive lead charges do not blend together properly.



While the operator is skillfully agitating the Hill Standpipe, a new charge of molten Stabilized Lead flows through the Hill Standpipe into the press. Consequently, not only does the filling take place from under the surface of the previous charge, but the new charge is also thoroughly blended with the previous one.

Ultrasonics are Making a Significant Contribution to the Manufacture of Reliable Cable Sheaths

Thin, weak areas in a cable's sheath are a common source of paper cable failures. These "thin spots" are caused by inadequate control of the lead sheathing operation. In 1941, Okonite engineers introduced a new electronic technique for the control of this procedure. It was called the Electronic Uniformity Gauge. The latest revision of the uniformity gauge employs ultrasonic resonance waves to measure the thickness of the sheath being manufactured. These measurements, accurate to 1/1000th of an inch, are then projected on a cathode tube where they can be observed by the press operator. Consequently, an Okonite lead press operator is able to keep a constant check on the thickness of the sheath his press is extruding. As a result, Okonite paper cable sheaths average only 3% variation in thickness. AEIC specifications, depending on the situation, allow a maximum variation of 10%. Okonite, however, self-imposes a maximum 7% variation in all cases. Quite a difference. In other words, Okonite paper cable sheaths *on the average* are 3⅓ times more uniform than the industry specifications require and *are always* nearly 1½ times more uniform than these specifications require.

. . . 3% vs. 10%

1. The Hill Standpipe Method and
2. the Electronic Uniformity gauge . . .

. . . two concrete examples of the devoted ingenuity that Okonite applies to the manufacture of paper cables. This is all evidence to the fact that Okonite paper cables contain *added values*, values that are not written into specifications.

Today, every good engineer I know is seeking ways to get the maximum value out of the money he invests for his company or client. The *added values* in Okonite paper cables provide an opportunity to get extra life and dependability out of electrical cable systems. As one engineer to another, I urge you to become better acquainted with the long range economy of Okonite paper cables.

If you have not received your copy of the new Okonite paper cable catalog, or if I can be of help to you with a current problem, please get in touch with me at The Okonite Company, Passaic, New Jersey. 6061

where there's electrical power . . . there's OKONITE CABLE

Electric Lawn Mower—Real or a Dream?

When we proposed in this column a few weeks ago the creation of an "Electrical Dreamers Club," we didn't anticipate the problem of sifting dreams from realities.

Then, last week came a call from one of our wide-awake readers asking us if we knew who makes a battery-driven lawn mower. Somewhere he has heard about such a device. But neither he nor we have any idea whether such devices are in production or which manufacturers may be interested.

Let us say right off that we have no preference for a battery-driven lawn mower over a regular electric mower. On the other hand, if the battery driven mower will broaden the market for kwhr sales, we're definitely interested.

In fact our mind already has started toying with the idea of those battery chargers singing away on a Saturday or Sunday after the man of the house has completed his weekend rounds of a thriving lawn.

As for the "Dreamers Club," we're in business. The first ideas will be published in our Readers Forum column next week.

But right now, does anybody know who makes a battery-driven lawn mower?

Fischer Black

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Exclusive New
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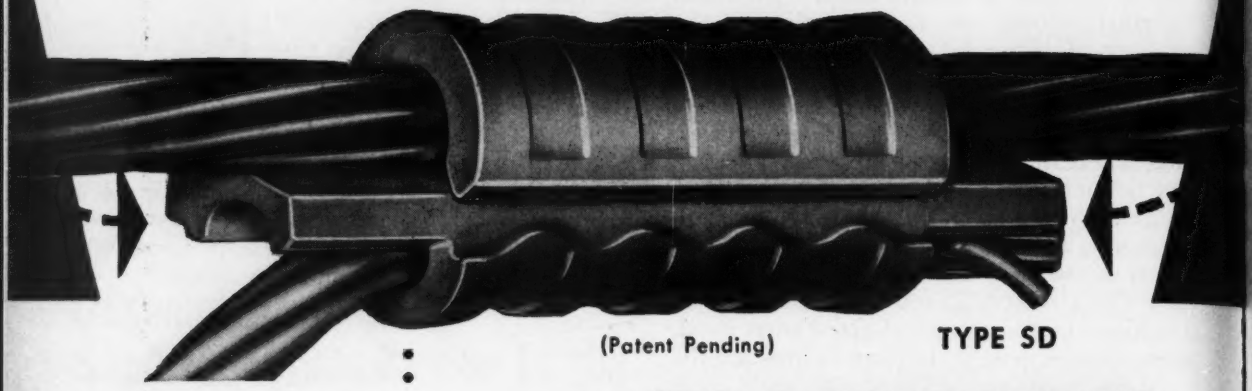
SEPARATOR

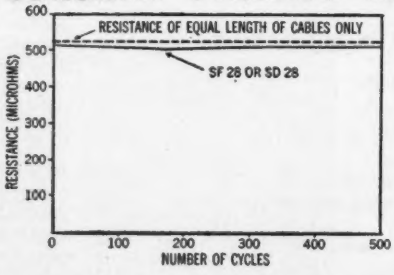


(Patent Pending) TYPE SD

in BLACKBURN 6-Frame Tap Connector

- **Assures Separation of Conductors**
- **Provides Needed *Extra* Protection on Bi-Metallic Connections**

CURRENT CYCLING TEST TELLS THE STORY



Current Cycling Test Conditions:

1. Cables: 4 Stranded Copper; 2 ACSR.
2. Cable operating temperature: 125° C.
3. Cycle: 2 hours "On", 1 hour "Off".
4. Length of connection: 24 inches.
5. Resistance of equivalent length of wire: 522 microhms.
6. Cables were wire-brushed, but no protective compound was used.
7. Curves represent an average of seven tests.

This rugged Blackburn design provides protection for conductors from both galvanic corrosion and physical damage. The Blackburn Drip-Guard Separator, plus the completely enclosed tap, prevents corrosion products from bridging the gap between the copper and aluminum conductors. Copper wire now can be used as main or tap without corrosion damage to the aluminum conductor.

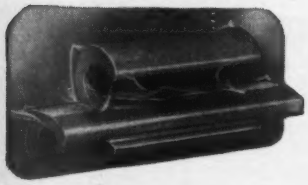
In addition, the superior Blackburn design, which incorporates external channels parallel to the tap hole, assures uniform encirclement of both conductors when compressed.

Shot-blasted surfaces protected by an oxide-inhibiting film insure oxide-free connectors at jobsite.

Type SF Recommended for Aluminum to Aluminum

This Blackburn 6-Frame Tap Connector assures complete separation and protection of the conductors. The Drip-Guard is unnecessary for this application.

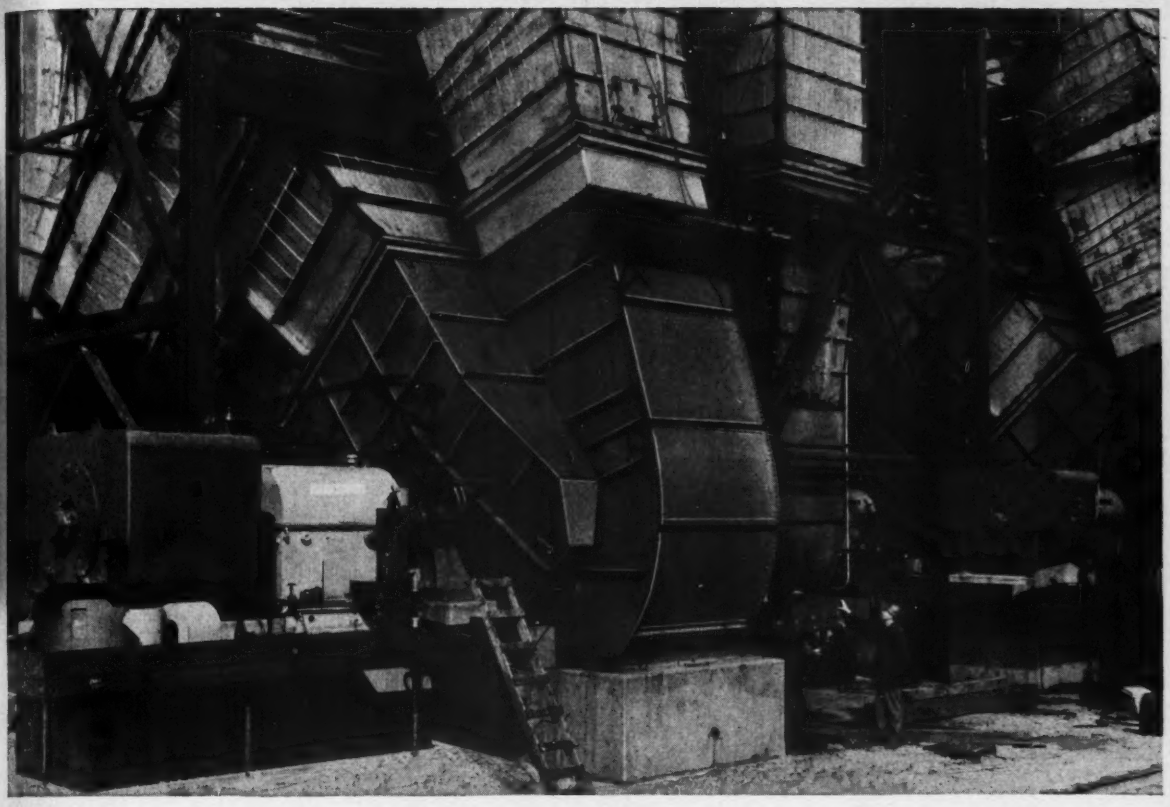
Both Designs Available *Pre-Filled*



Type SD or SF may be ordered pre-filled with Blackburn's superior oxide-inhibiting compound, Contax. Pre-filling eliminates the possibility of an installation being completed without inhibitor.

Write for samples

LIVE BETTER ELECTRICALLY



LOOKING FOR PEAK EFFICIENCY OVER BROAD RANGE FOR YOUR DRAFT FANS?

Here's Why "Buffalo" "BLH" is Best Answer:

The "Buffalo" Family of "BLH" Fans is designed for highest mechanical efficiency over an extremely broad operating range. Peak efficiencies are up to 86%. Rugged "Buffalo" construction insures economical, dependable operation throughout a long, trouble-free life.

"Buffalo" Type "BLH" features include: streamlined housing designed to deliver ultra-smooth air flow, peak static conversion and pressure distribution at outlet — turbulence minimized by smooth inlet bell, directional inlet vanes, backward-curved blades, matching rotor flange and inlet bell and gradually divergent outlet. These features all add up to the quiet, powerful, smooth performance characteristic of the "BLH".

Reliable, maintenance-free operation is the result of extra-heavy construction throughout. This includes sturdy steel plate construction ruggedly welded for extra strength — oversized shafts and bearings. Rotors are statically and dynamically machine balanced at factory.

If your mechanical draft conditions require a dependable fan that provides high efficiency over a broad operating range, ask your "Buffalo" engineering representative for complete facts about the "Buffalo" family of mechanical draft fans. Or you can write us direct for Bulletin FD-905.

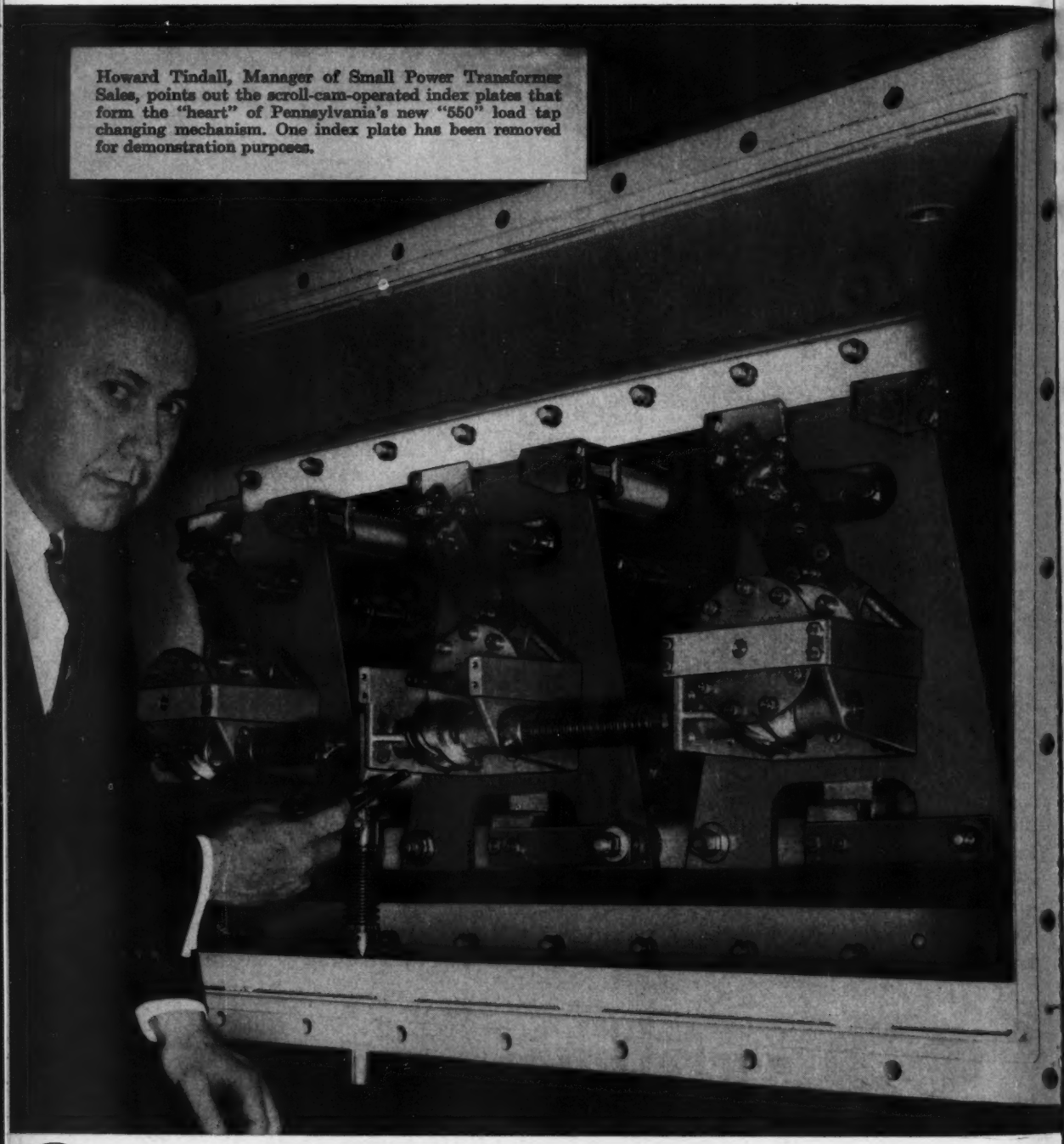
"Buffalo"

BUFFALO FORGE COMPANY
Buffalo, N. Y.

Buffalo Pumps Division • Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ontario

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

MORE THAN A PRICE



Howard Tindall, Manager of Small Power Transformer Sales, points out the scroll-cam-operated index plates that form the "heart" of Pennsylvania's new "550" load tap changing mechanism. One index plate has been removed for demonstration purposes.

PENNSYLVANIA POWER

E REDUCTION!

Direct-drive unit now standard on Pennsylvania LTC Transformers rated 10,000 kva and below

New "550" LTC mechanism brings SAVINGS UP TO 18% plus operating advantages

Lest the fact be overlooked in all the talk about price reductions, it should be pointed out again that power transformer purchasers get *more for less* as a result of Pennsylvania Transformer's recent 10 to 18% reduction in the cost of load tap changing transformers rated 10,000 kva and below.

The reason is simply that Pennsylvania's LTC price reduction is the result of a major improvement in LTC design. Operated by direct drive, the "550" LTC mechanism is a *much simpler* but also a *much more rugged* mechanism than the unit it replaces. Thus, in addition to important savings in initial purchase cost, Pennsylvania's new load tap changing mechanism provides the following advantages on all LTC three-phase transformers covered by ASA Standard C57.12A, on special transformers in equivalent sizes, and on equivalent step voltage regulators:

Easier, less costly installation

The new "550" is only half as large as the LTC mechanism it replaces, and weighs only 25% as much as the old unit. This means easier handling, smaller pads or platforms, and savings in installation time and costs.

Year-in, year-out uniformity of operation

Direct drive of contacts through a scroll cam and index plates means that switching speed and positioning will remain uniform throughout many years of operation. Splined shafts preclude any misalignment of drive components.

Longer contact life, less oil deterioration

Optimum switching speed—accomplished by use of the scroll-cam-operated index plates—means that the arc is interrupted more efficiently, with less contact erosion and less oil deterioration. This results in less oil maintenance and longer contact life.

Quieter operation

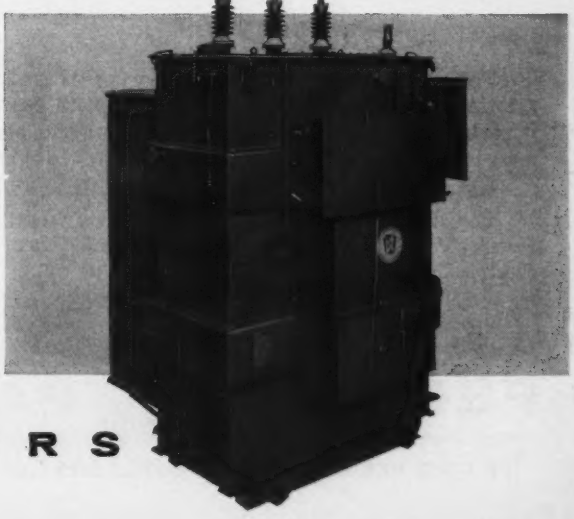
Completely controlled movement and speed made possible by the direct-drive design eliminates bumper springs. Contacts close gently, without bounce or excessive mechanical shock.

Easier inspection and maintenance

Inspection of switch compartment is faster, easier because only half as much oil is used as in the previous compartment. Both switch and drive compartments contain subassemblies that are relatively easy to remove and replace.

These economic and operating advantages are just a few of the reasons why Pennsylvania's new "550" LTC gives you *more for less.* For additional details or a discussion of your own utility's needs, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa. Phone: Sherwood 5-9100.

McGRAW EDISON



T R A N S F O R M E R S

Federal Pacific Metal-Clad Switchgear is made compact...rugged... and in increasing numbers!

Federal Pacific Metal-Clad Switchgear does the job—it's proven by the growing list of installations across the United States and abroad. Most important, Federal Pacific does it with stronger materials, fewer parts, most modern design, and complete safety to operating personnel.

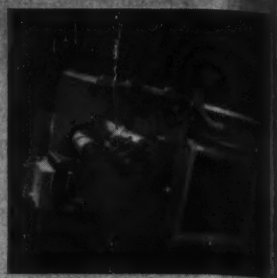
It's rugged...it's safe...it's easy to maintain...it's accepted!

For the full Federal Pacific Metal-Clad Switchgear story call your Federal Pacific engineer or write for Catalog No. 3-440, Federal Pacific Electric Company, Newark, New Jersey.

FEDERAL PACIFIC

The Best in Electrical Distribution and Control Equipment

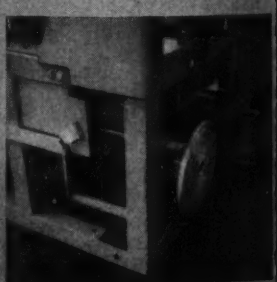
FEDERAL PACIFIC METAL-CLAD SWITCHGEAR OFFERS UTILITIES THESE SPECIFIC ADVANTAGES



● **BREAKER MECHANISM IS COMPLETELY SELF-CONTAINED**—Attached to frame by only four bolts. No bearings or shafts are in contact with frame. Breaker mechanism can be removed for inspection and maintenance as a unit—simply and quickly.

● **PRIMARY DISCONNECTS ASSEMBLY MOUNTS ON BREAKER AS A UNIT**—Complete six stud bushing sub-assembly mounted directly on breaker facilitates inspection and service.

● **SIMPLE RACKING-IN MECHANISM**—Only two moving parts...provides positive safety inter-locking in any position.



● **CLOSING SOLENOID MAINTAINS TORQUE TO END OF STROKE**—Plunger disc gives solenoid additional pull at the end of the stroke when most needed...to compress closing springs and make positive contact.

The Electrical Week

LATE NEWS ▶ **EEI answered the call for "promotional leadership" last week** in Chicago at its 25th annual sales conference, by revising aims and structure of the old Commercial Div, changing its name to Sales Div. Said E. O. George, vp of Detroit Ed and chairman of the new division's executive committee, "Competition has indicated the need for more than an information-exchanging association."

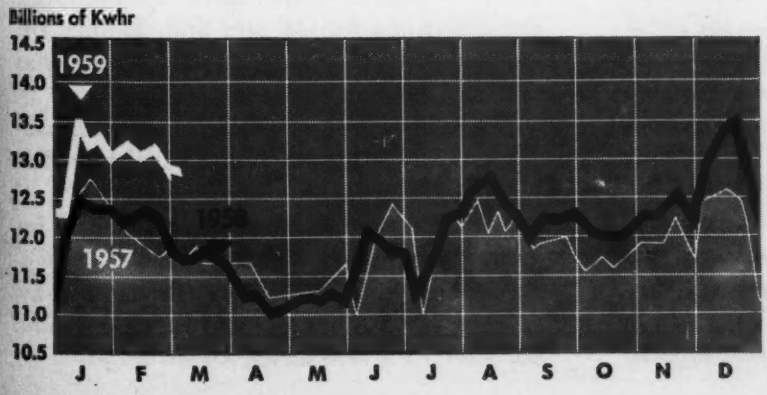
Greatest danger to power companies on TVA frontiers, if the TVA bond bill passes, is that the companies will have a difficult time financing new facilities of their own. That's the consensus of officials of the "frontier" companies who spoke in Washington last week. Harllee Branch, Southern Co president, said: "The inexorable effect" of TVA bond legislation would be to "put uncertainty in the minds of our investors."

Two features of the bills (HR-3460 in the House and S-931 in the Senate) which they cited as particularly bad were: 1. Lack of Congressional control over TVA operations; and 2. No effective restriction on the TVA service area. Although the TVA bills claim to provide controls and limitations, American Electric Power's Executive Vp Donald Cook called the provisions illusory. "Aggrieved utilities would have no recourse from TVA infringement," he said, "if the proposed bill is enacted as written."

Carolina P&L's Pres Louis Sutton called the bill a "masterpiece of concealment," and added that his company could not compete with TVA—if it expanded—as long as Carolina P&L has to pay twice as much to produce power.

Six utility spokesmen said that the proposed bills would permit TVA eventually to capture from 20% to 100% of their business. For more on TVA bonds, see "Politics and Public Power" on p 12.

***WEEKLY POWER OUTPUT*—UP 9.8%** (Week ending Mar. 7), Kwhr 12,945,000,000



Per Cent Change From Previous Year

	Feb. 21	Feb. 28	Mar. 7
Total U. S.	+ 7.5	+ 9.9	+ 9.8
New Eng.	+ 9.7	+ 8.9	+10.0
Mid. Atlantic ..	+ 7.5	+ 7.3	+ 7.8
Cent. Ind.	+ 9.2	+12.9	+12.6
West Cent. ...	+ 6.4	+10.5	+ 8.5
Southeast	+ 0.5	+ 7.7	+ 8.5
South Cent. ...	+ 9.0	+12.2	+11.8
Rocky Mount...	+13.7	+ 9.9	+ 8.6
Pacific			
NW	+14.7	+12.5	+ 7.4
SW	+13.0	+ 7.7	+ 9.6

Seasonally Adjusted Index 250.4

Week Ago 251.9 Year Ago 227.7

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Of pending rate increase requests, about half have been delayed.** Reasons for the roadblocks range from politics to the heavy work load of regulatory commissions **(p 48)** . . . A New York designer is looking for financing for an electric car that would cost $750, weigh 350 lb, and operate on $3 of electricity a month **(p 49)** . . . Pacific Northwest Power Co has come up with plans for a fish bypass canal which the company believes answers fish interests' objections to High Mountain Sheep Dam **(p 51)** . . . When REA loans permit a co-op to "raid" your service area, there is no recourse to the courts. This is the complaint that Charles Whitmore, head of Iowa-Illinois G&E lodged before the Senate Agriculture subcommittee **(p 52)**.

ENGINEERING ▶ **EEI's T&D Committee debates higher utilization voltages,** underground distribution, and storm damage prevention on **p 53** . . . A coal supplier with an assured market passes on his cost savings to the electric utility user **(p 54)** . . . If you want to know how to iron out industrial plant voltage dips, turn to **p 56** . . . To save on transmission planning, here's a way to combine aerial photography, ground control data, and profile development by stereoplotting instruments **(p 59)** . . . American Public Power Association hears high praise for the combined gas-turbine steam-turbine cycle **(p 66)**.

Politics and Public Power

ODDS FAVOR TVA BOND BILL

Tennessee Valley Authority is probably going to get Congressional approval to establish its own bond financing. That seems to be in the cards—politics being what they are.

And President Eisenhower's line on TVA isn't likely to mean any tightening of the restrictions now being considered. The political weapon he has is his veto. And there are all kinds of speculation about just what the President will do if the bill reaches his desk.

The top GOP Congressional leaders—Rep Charles Halleck and Sen Everett Dirksen—stood on the steps of the White House after talking to Eisenhower and described what Eisenhower wants for the valley.

But Eisenhower's specifications—as laid down by his Congressional lieutenants—may not be acceptable to Congress.

Actually, Halleck and Dirksen were vaguely trying to raise the ghost of a threat of a Presidential veto if the present language on key points is liberalized.

Right now, there seems little doubt that the provisions of the Democratic bill will be the ones that go to the White House.

The bill is identical to the Kerr bill which passed the Senate in 1957 and got as far as the House Rules Committee in July, 1958. Sen Robert S. Kerr (D-Okla.) again has introduced the bill in the Senate, and both Houses are expected to vote for the legislation exactly as introduced.

The bill is a blunt one, with few consolations to private utility objections. It provides:

- $750-million limitation on total bonded indebtedness at any one time.
- An "area limitation" for facilities built by revenue bond funds, defined as lying within counties TVA now serves.

SELLING ▶ **Heat pumps can give high usages another upward push,** says Southern Nevada Power Pres Reid Gardner, if the weather cooperates. Gardner should know: His company's annual residential usage jumped 579 kwhr last year—to 9,952 kwhr per customer **(p 62).**

MANAGEMENT ▶ **Net incomes rose 7.7% in 1958** for a 144-company sample of the investor-owned electric utility industry. Leading region in income growth was the Pacific Coast **(p 83).**

MANUFACTURERS ▶ **New designs of lightweight transmission towers promise lower costs** per mile of line . . . U. S. Bureau of Mines pushes research on coal-fired gas turbines for utility plants **(p 67)** . . . Pennsylvania Power plays host to employees of Westinghouse Transformer Div . . . GE installs balance testing facility **(p 70).**

NEW EQUIPMENT ▶ **Cutout features bronze, parallel-groove terminals, expendable caps.** It is available in 5.2, 7.8, and 15-kv ratings for 100 and 200 amp . . . Battery chargers have generator, motor, and control panel integrated into one unit . . . Recorder-controllers feature D-Pak constant voltage supply unit that eliminates batteries, standard cells, and standardizing mechanisms in potentiometers **(p 72).**

• TVA may skirt this limitation to serve federal installations, co-ops already served by TVA, other utilities for power exchange and to tie in its own facilities.
• Communities now served by TVA may expand areas up to five miles outside TVA limits.
• TVA must pay minimum of $10-million annually to the U. S. Treasury from its unappropriated fund.
• Congressional veto of bond-financed construction within 90 days of notification.
• 15-day notification period to the Secretary of the Treasury on new bond issues plus a 45-day delay, if the Secretary wishes.

The House Public Works Committee took two days recently to hold hearings on its new TVA bond-financing bill (HR-3460), but the result was never in doubt.

Other than sponsors, the only witnesses testifying for the bill were from TVA and the TVA Public Power Assn. Opposition witnesses included spokesmen from most power companies located in the TVA area, National Coal Assn, United Mine Workers, National Assn of Professional Engineers, Southern States Industrial Council and several Congressmen: Ben Jensen (R-Iowa), John Sayre (R-Pa.), Arch Moore (R-W. Va.), Carl Vinson (D-Ga.), and Elizabeth Kee (D-W. Va.).

TVA will keep cropping up as a political story when the Dixon-Yates controversy will be touched off again with hearings opening next week on the confirmation of Lewis Strauss as Secretary of Commerce.

Kefauver and other pro-TVA senators will use the appointment to whip public recollection of the controversial case. They can expect some support from freshmen liberals seeking to make an impression.

Almost all power nuclear reactors in operation, under construction, or in advanced design stages have their status defined as a result of the Second International Conference on the Peaceful Uses of Atomic Energy. Along with the pressurized-water type and the gas-cooled natural uranium graphite-moderated type, the water-cooled, graphite-moderated reactor appears most important. **Power Reactor Technology, Vol 1, No. 2, December, 1958, AEC.**

Uses of the Peltier thermoelectric-cooling effect will be studied under a two-year research program sponsored by 16 industrial firms. Compounds and alloys of 22 metal systems are involved. **Battelle Memorial Institute.**

Computer forecasting of the weather will become an important part of the operation for Britain's Meteorological Office. Routine preparations of weather reports are to follow research studies on the electronic digital computer. **British Information Services, New York.**

TECHNICAL NOTES

Protect the investment in rotating electrical machinery through proper care during repairs or overhauls. Simple "do's and dont's" can extend the life of commutators, windings, and bearings. **Preventative Maintenance Starts with Installation, E. H. Myers, Maintenance News, Vol 23, No. 1, Westinghouse Electric Corp, E. Pittsburgh.**

Kvar of shunt-type capacitors installed on the secondary bus should be 25-33% of the capacity of the distribution transformer feeding the bus.

Dc submarine cables with a permanent filling (oil or compression types) may exhibit better aging characteristics than the classic impregnated paper cable.

FROM EDITORS IN THE FIELD

Significant errors can occur in efficiency tests of large hydro generators with Kaplan-type turbines if ASME windage formula for unwatered turbines is used. Special tests showed the ASME value to be 2.5 times that actually measured for turbines of 73.7-Mva generators at McNary Dam.

Radio isotopes measure moisture in coal as it moves continuously to the dryer. This scheme is under development for the **Victorian State Electricity Commission, Australia.**

They roll with the punch!

It's simple to say "I'm all done" when you have designed a bushing for normal service. This is not true. One of the toughest chapters in a bushing's life is getting it to its work. It travels on trucks or freight cars. It may have a heavy 'ruptor mechanism attached to its lower end. It may be loaded and unloaded several times by freight handlers who don't exactly give it "kid glove" treatment. It gets still more handling on the construction site.

Powerful endwise compression, developed by *coil* springs -- an original O-B development -- keeps bushings tight and perfectly aligned against any lateral movement in spite of severe accidental shocks. In the extreme case, the assembly can give and recover because coil springs permit slight movement under constant sealing pressure without damage to themselves or to other parts. Briefly, O-B bushings can "roll with the punch."

This gets O-B bushings onto the job in the same condition they left the factory -- a mighty important thing for bushing users to think about -- especially in the case of O-B where *no better bushing* comes out of *any factory*.

It is easy to avail yourself of this extra advantage. Just express your bushing choice when you purchase new station apparatus. Say, "O-B equipped." Name it, and you can have it!

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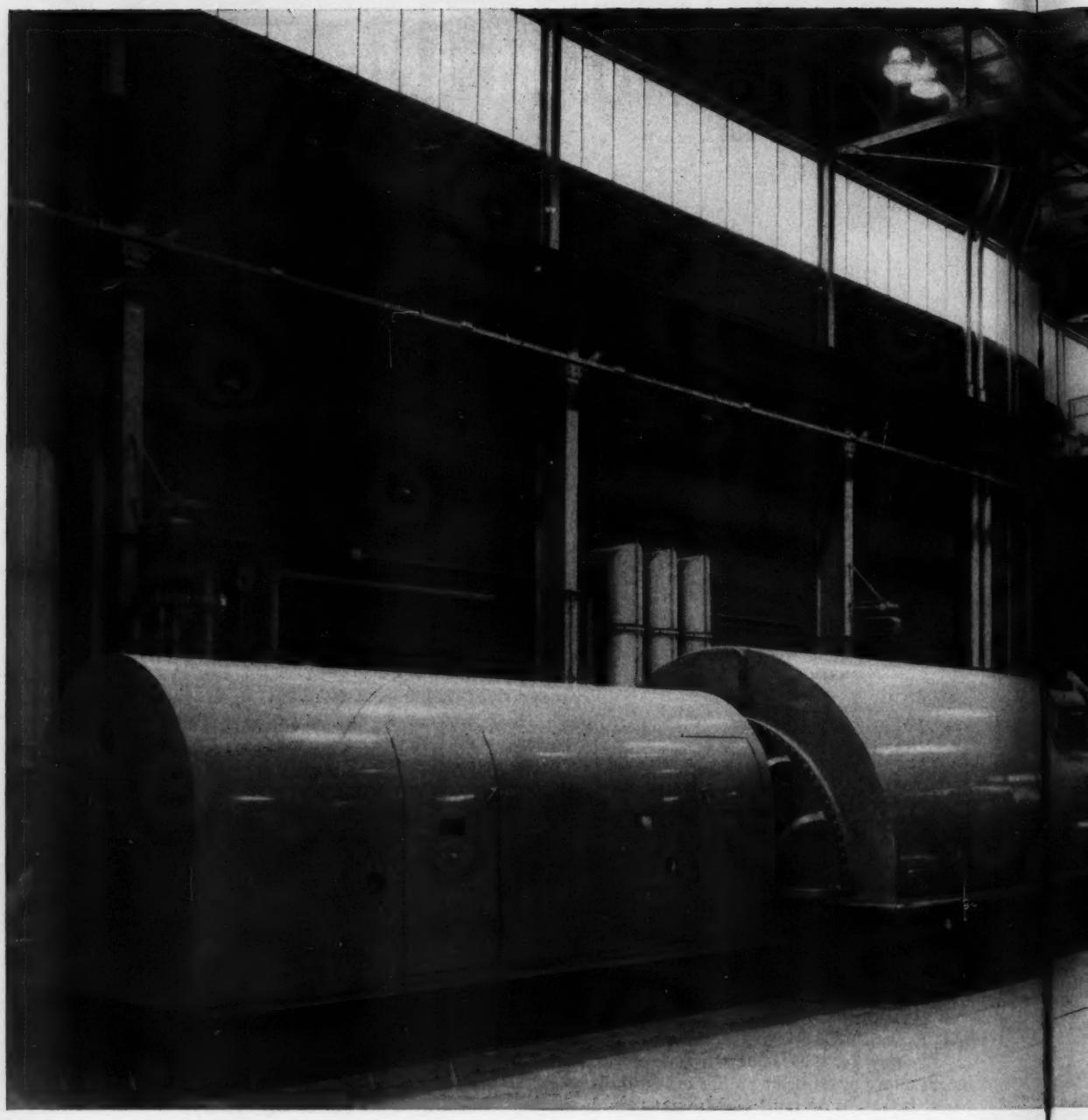


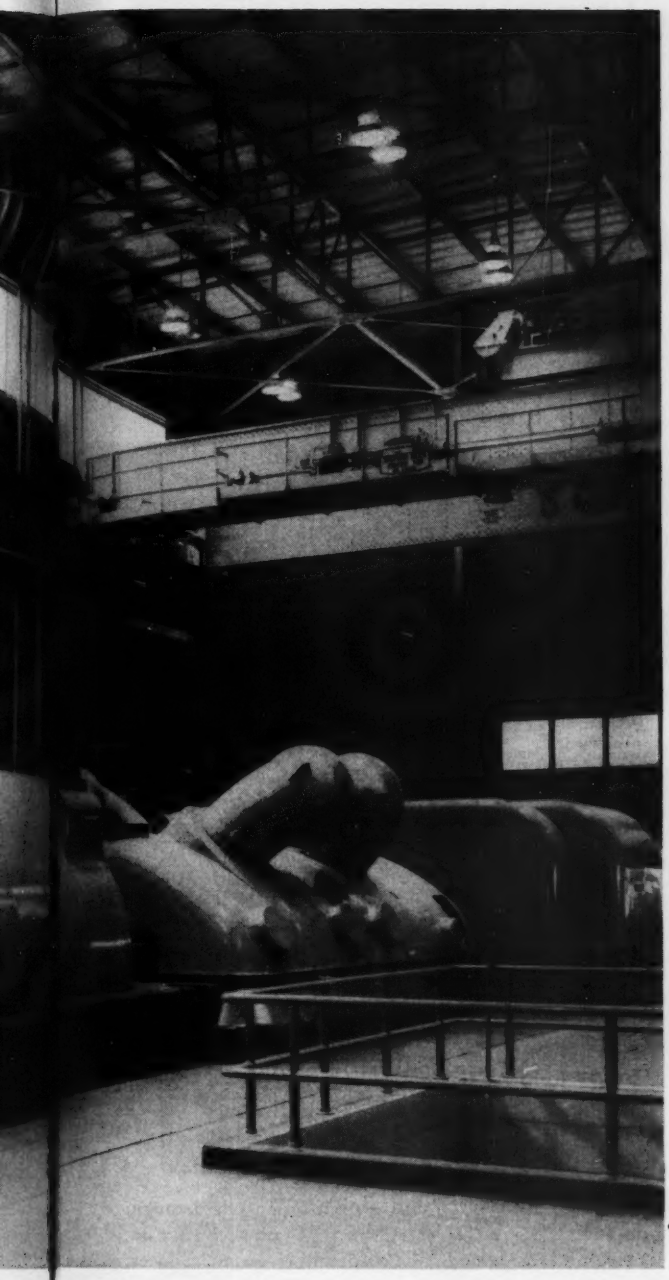
Gulfcrest Oil logs 21 years of service in turbines

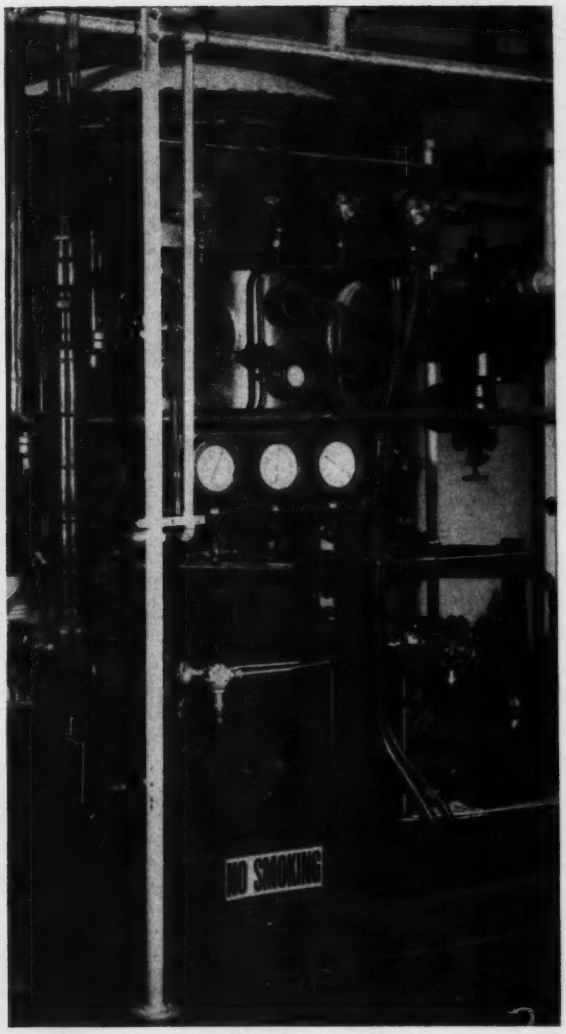
GULF MAKES THINGS

"We've used Gulfcrest Oil for over 21 years, at six of our major plants, in generators aggregating approximately 700,000 kilowatts capacity. We find that Gulfcrest meets all our requirements for effective turbine lubrication. With Gulfcrest, there's no foaming, sludge formation, or rust, and neutralization numbers remain consistently low."

That's the report from William R. Wise, Plant Superintendent at the Milliken Station near Ithaca, New York, one of six major plants owned and operated by New York State Electric & Gas Corporation.

Gulfcrest is the world's finest turbine oil—and we can prove it! In Gulf's marketing area, more





Hydrogen detraining equipment for Unit No. 1 at Milliken Station. Since the turbine uses hydrogen cooling, this equipment is needed to remove any hydrogen that accumulates in the lubricating oil.

Unit No. 1 at the Milliken Station of N. Y. State Electric and Gas Corp. This is a 150,000 kw, 3600 rpm unit, operating at 1800 psig and 1000°F. with reheat to 1000°F. Its lubricating system contains 5,000 gallons of Gulfcrest 44 Oil.

at N. Y. State Electric and Gas . . .

RUN BETTER!

power is generated by central station steam turbines lubricated with Gulfcrest than with any other oil.

See how Gulf makes things run better. Get all the facts about Gulfcrest from a Gulf Sales Engineer. Just call your nearest Gulf office or write for illustrated booklet.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

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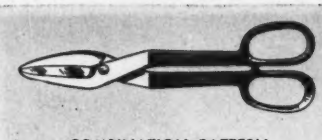
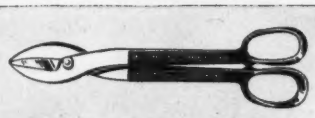


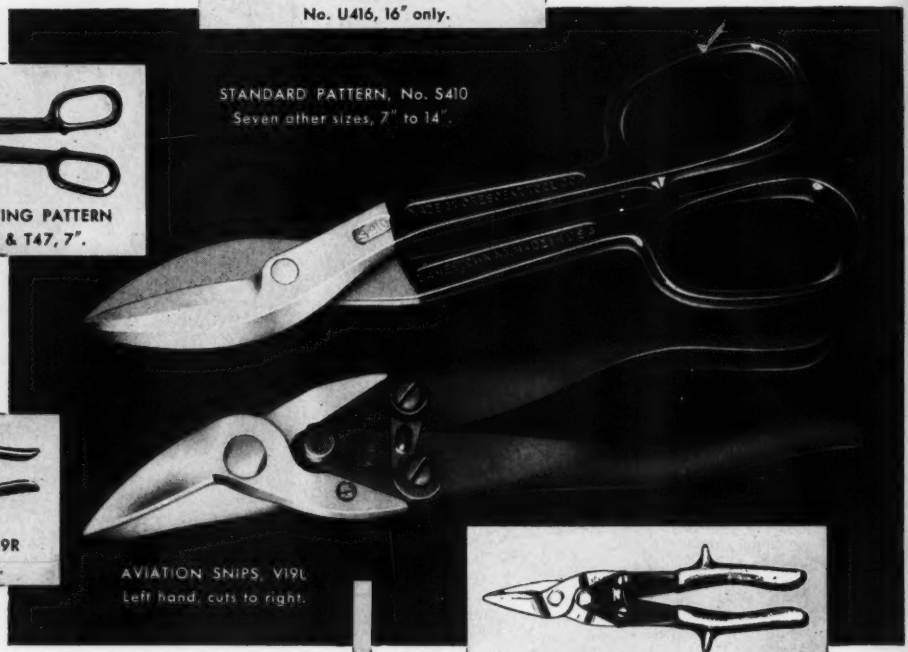
COMBINATION PATTERN
No. U412, 12" only.

SNIPS FOR EVERY SERVICE



HEAVY DUTY PATTERN
No. U416, 16" only.

CIRCULAR CUTTING PATTERN
No. T412, 12" & T47, 7".



STANDARD PATTERN, No. S410
Seven other sizes, 7" to 14".

AVIATION SNIPS, No. V19L
Left hand, cuts to right.

AVIATION SNIPS, No. V19R
Right Hand, Cuts to left.

NEOPRENE INSULATING SLEEVES
Available for all Aviation Snips. Here shown on No. V19S, straight cut.

Crescent Tinners' Snips are forged of selected steel and blades ground on special grinding machines. They are hardened by Crescent's own selective induction process to insure long, satisfactory service. These easy-cutting, well-balanced snips are made in four patterns; standard, circular cutting, combination and heavy duty.

Sold by hardware dealers and industrial distributors everywhere.

AVIATION SNIPS. Keenly ground, hard, tough alloy steel blades with machine serrations...can be factory reground. Compound leverage produces tremendous shearing power. Three patterns.

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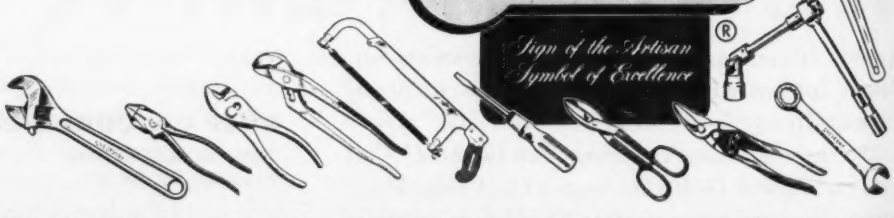
Give Wings to Work
Sign of the Artisan Symbol of Excellence ®



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CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

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Used in Conjunction With

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Atomic Tests

What is the specific application of this cable? Frankly we haven't been told; but it was precisely engineered to rigid government specifications.

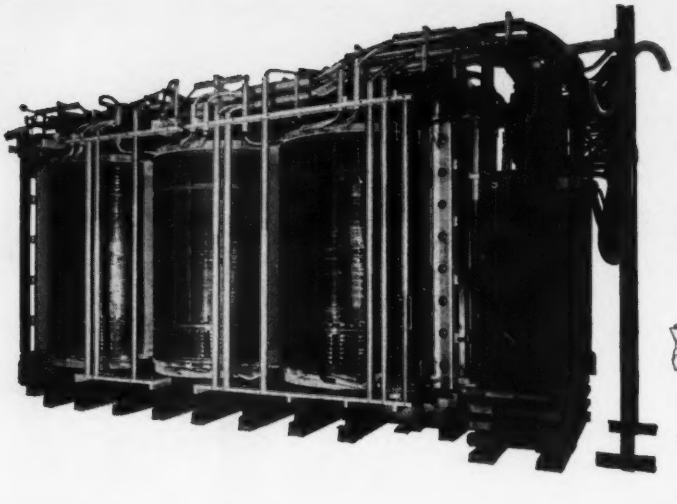
Call in Paranite on your next cable problem —they've been solving them since 1890.

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

Sales Offices in all Principal Cities



The completed core-and-coil assembly showing the main, series and reactor transformers.

Note the substantial framework, the method of insulating and supporting the leads and the quality of workmanship, all of which are inherently a part of Moloney transformers.

Recently shipped to Consolidated Edison Co., of New York: two 100,000 KVA, 138 KV transformers designed to maintain proper voltage on the Consolidated Edison, Staten Island System

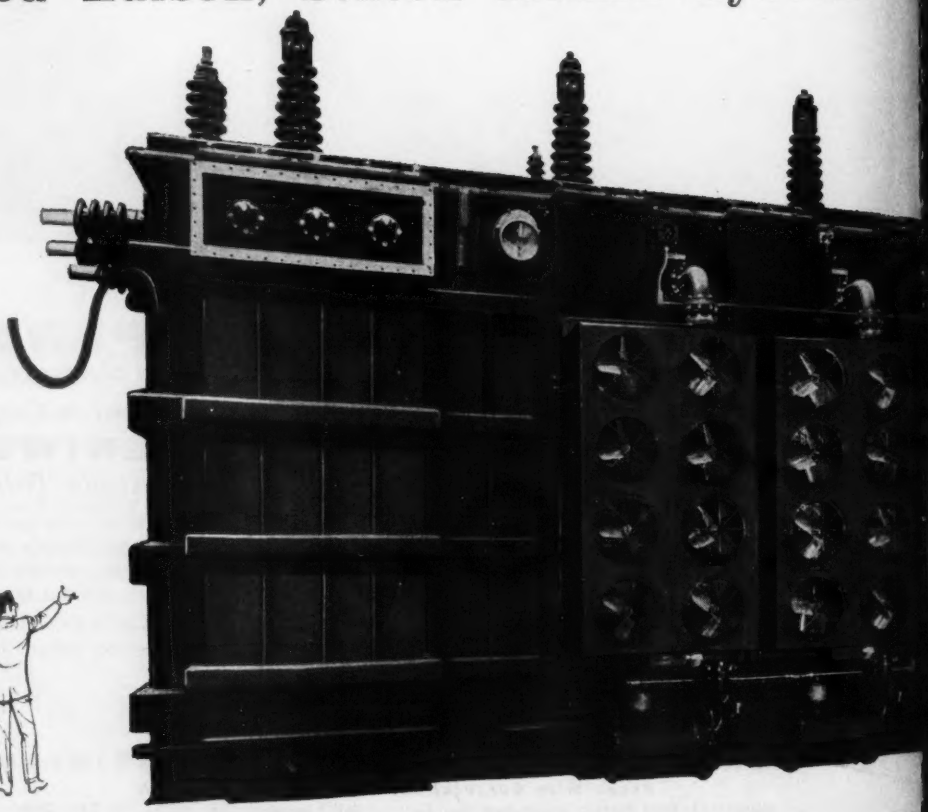
Low voltage side of a three phase, 60 cycle, LTC transformer, type OA/FA/FOA rated:

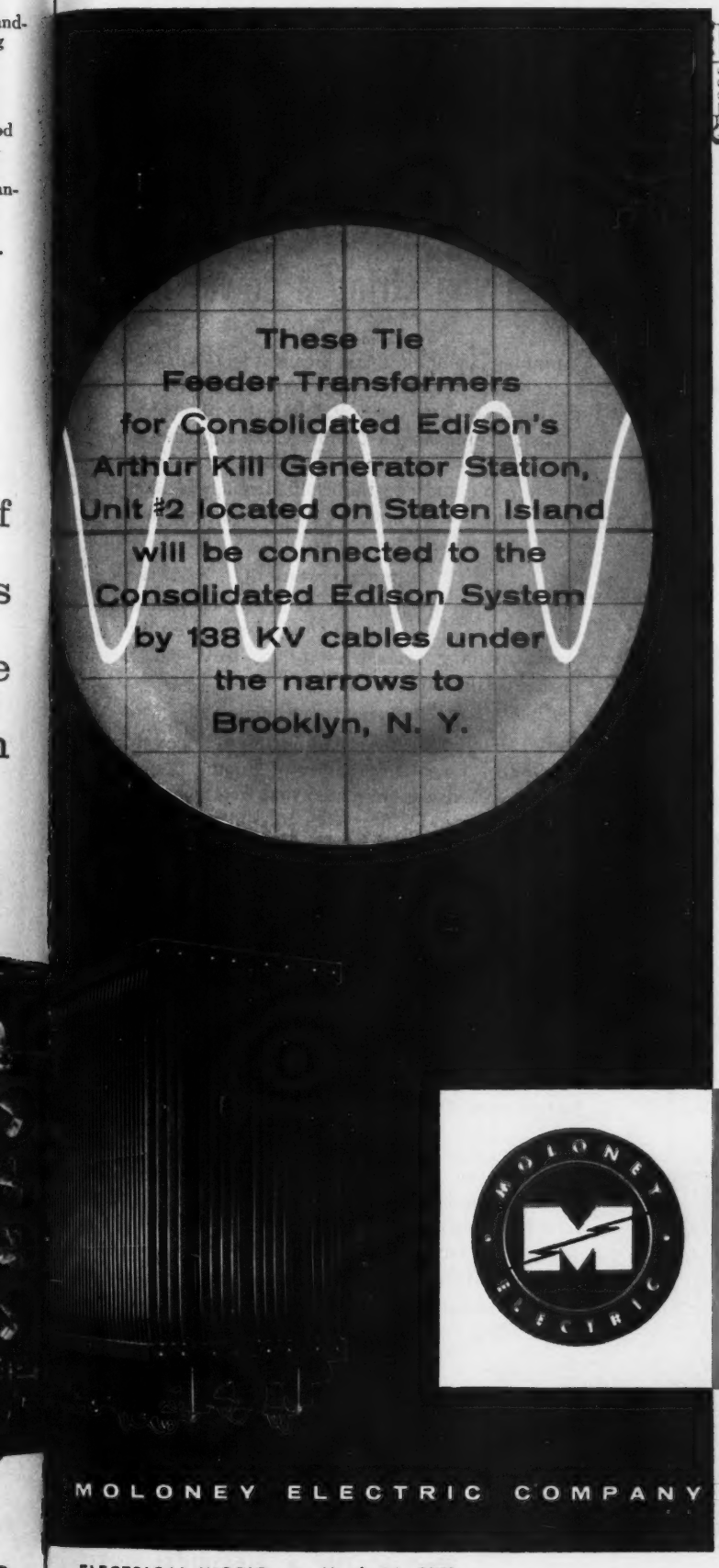
60,000/80,000/100,000 KVA

—High Voltage: 132,000 Volts

—Intermediate Voltage: 35,000Y/20,200 Volts

—Low Voltage: 13,800Y/7960 Volts at 12,000/16,000/20,000 KVA





These units are 60,000/80,000/100,000 KVA, three phase, sixty cycle, type OA/FA/FOA transformers rated as follows: high voltage 132,000 volts, intermediate voltage 35,000Y/20,200 volts, low voltage 13,800Y/7960 volts at 12,000/16,000/20,000 KVA. They are equipped with load tap changing equipment in the 35 KV intermediate winding for plus or minus 12% regulation to provide regulated voltage for the Staten Island load.

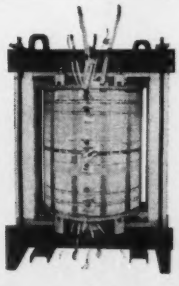
The 13.8 KV winding is designed to provide start-up auxiliary power for Arthur Kill Generating Station, Unit #2, which has a rating of 335 MW. To stabilize the voltage of the intermediate winding due to this start-up load on the low voltage winding, a zero or slightly negative impedance is utilized in one branch of the equivalent impedance diagram.

Due to the complexity of this design, Moloney built and tested a prototype to obtain the best possible design. The tests conducted on the prototype included tests to determine surge voltage distribution and impedance.

Another feature of these units, which was specified by the Consolidated Edison Company, is that they have a sound level considerably below the standard NEMA level.

Moloney Power Transformers are available in all voltage and KVA ratings in special or in standard designs. Contact your Moloney representative for information on any size or type transformer . . . Specify Moloney Transformers . . . All Along the Line.

MEB9-1

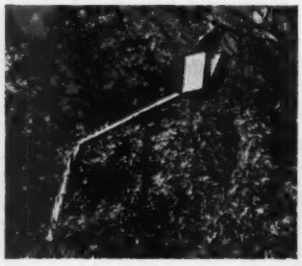


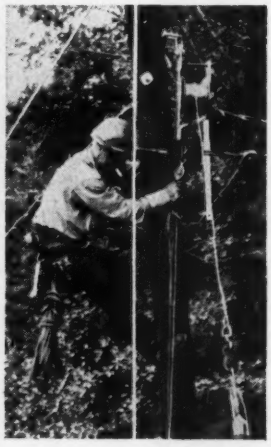
Prototype of windings, used to determine surge voltage distribution and impedance.

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES
FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA





SAVE YOURSELF THAT SECOND TRIP

when you string a power line

"Spinning" an aerial cable means going over your work twice—once to string the messenger, and again to bind the cable. It costs you valuable installation time.

Rome's preassembled aerial cable can save you that time—and the extra trip. It has a messenger *ready-bound* to the cable and can be installed much faster than its field-assembled *or* open-wire counterparts. And it provides other advantages for:

Storm protection

Stronger than open-wire systems, Rome's preassembled aerial cable reduces the danger of damage resulting from storms. Falling branches—or even trees—can be supported by the cable itself.

Reduced tree trimming

Initial and periodic tree trimming are reduced to a minimum. In a recent installation of Rome's preassembled aerial cable, it was estimated that tree trimming would not be required for five years, in contrast to the normal two-year period for open-wire systems.

Ease of tapping

The reverse-lay construction of Rome's preassembled cable permits tapping anywhere along the line instead of just at termination points.

Improved regulation

Aerial cable has a lower reactance than open-wire systems—so voltage drop is approximately half as great. Similarly, for a given allowable voltage drop, power can be transmitted twice as far.

Improved appearance

No crossarms are needed with Rome's preassembled cable . . . the installation is simple, uncluttered, modern in appearance.

For more facts on this cable that can help *you* cut installation, operating, and maintenance costs, contact your nearest Rome Cable representative, or write to Dept. 772-B, Rome Cable Corporation, Rome, New York.

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FOR SUBDIVISION
LIGHTING...

SAN JOSE STANDARDIZED

with distinctive

UNION METAL fluted poles

San Jose, California, one of the fastest growing cities in the United States, has standardized on Union Metal 30-foot tapered, fluted steel Monotube poles for all new subdivision lighting.

This type lighting pole not only proved to be the most effective, but the permanency of construction, attractive appearance and economy of installation increased the preference for Union Metal.

Uniform lighting with Monotube poles has proved of value to many cities.

Residential subdivision lighting... standardized with 30' Monotube poles mounting incandescent luminaires.

UNION METAL

The Union Metal Manufacturing Company

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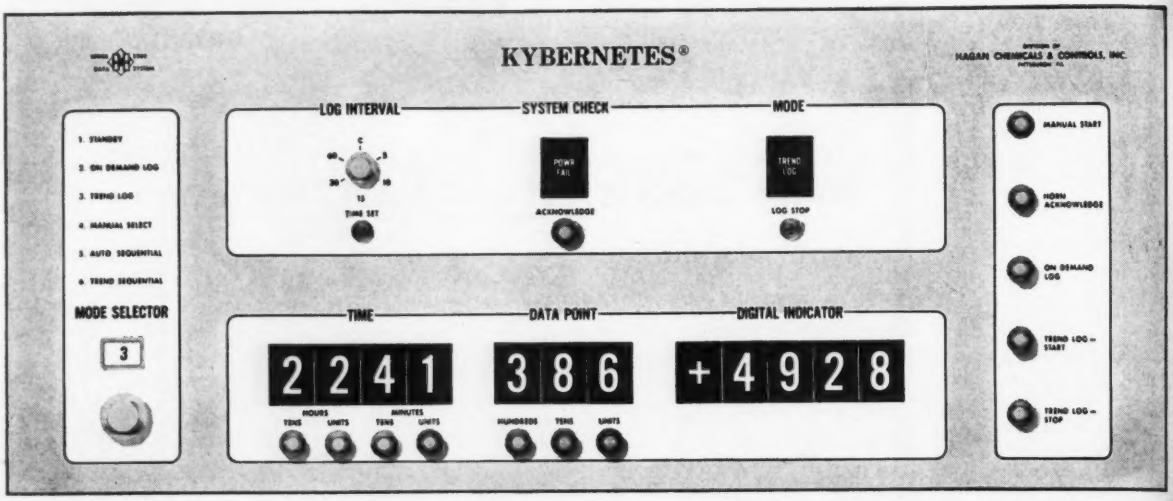
MONOTUBE LIGHTING POLES

Hagan Chemicals & Controls, Inc., announces the

COMPLETELY NEW



Kybernetes Series 2000 Data Processing System

The new Kybernetes Series 2000 Data Processing System, utilizing solid state components, adds many data handling advances to the outstanding features of the original equipment. Here are some of the features the new Kybernetes system has to offer:

NEW FLEXIBILITY—Basic unit is a simple logging unit for recording process data on a log sheet or other output device. This basic system can be expanded easily, both in terms of the number of points scanned, and the complexity of the operations performed by the unit. For example these can be added as need develops: *Scanning for off-normal conditions—Printed or visual trend of selected variables—Computing and integrating—Automatic programming and optimum setting of control.*

NOTE—*Any* or *all* of these functions may be performed without interrupting any of the other functions. Off-normal scanning *always* proceeds uninterrupted.

OPTIMUM RELIABILITY—Fewer components, simplified design logic and solid state components add to the inherent reliability of the system. All parts have been selected for long life and easy maintenance.

MODULAR CONSTRUCTION simplifies extension of system. Each new function can be added by simply plugging-in appropriate module.

SELF-CHECKING CIRCUITS immediately signal malfunction in any area and spot the area with a warning light.

ACCURACY of 0.1% on all inputs, including non-linear types is achieved by eliminating marginal techniques and components, using the highest quality components and by the use of simplified design logic.

Flexible, accurate and reliable, the new Kybernetes Series 2000 Data Processing System offers many previously unattainable advantages. Designed for maximum usefulness with minimum investment, *the new Kybernetes system permits the addition of functions as needed, including complete computer control.* A new brochure describes these advantages in detail. Write today for your copy; ask for Bulletin MSP-161.

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Another Order on the Way!

RT&E's Portland plant employees watch with pride as a shipment of distribution transformers is delivered to an important west coast customer.

This is typical of the fast service that is now available to all west coast transformer users from this new manufacturing plant.

Your representatives are cordially invited to visit us here in Portland and inspect the facilities that are at your service.

RT&E

ENGINEERING TALENT CONCENTRATED ON ONE IDEA
A BETTER TRANSFORMER

CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

* RT&E GROWS TO BETTER SERVE THE GROWING WEST

Are you paying for not having full-load, full-voltage switching on your distribution feeders?

If you are opening your distribution feeders with rotating-insulator disconnects—of the two-insulator side-break or three-insulator vertical-break type—you are already *paying enough* to get full-load switching at full-line voltage (as distinguished from loop sectionalizing . . . load splitting . . . where the voltage across the switch is low).

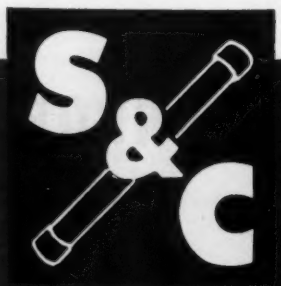
By using S & C's Side-Break Alduti Load Interrupters, you can have arc-free 600-ampere load switching through 14.4 kv at the same price, or at a lower price than you are now paying. Ordinary disconnects can, at best, only partially handle loop sectionalizing (that is, switching currents in parallel or loop circuits), let alone properly handle full-load, full-voltage switching.

Why do you need this switching capability? There are two important reasons:

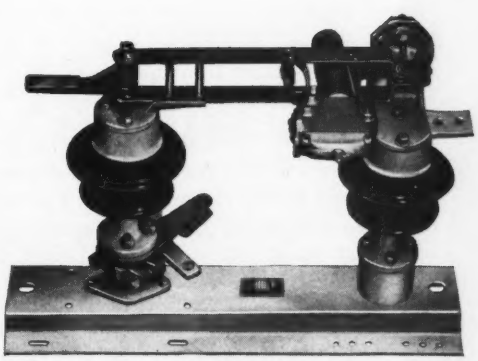
First—Emergency situations (wires down, etc.) demand quick action—dumping the load. And usually there is no time to set up communications for complicated breaker and switch sequencing.

Second—There's always the possibility of switching error, with the result that a loaded circuit may be inadvertently dumped.

If on the other hand, you are using budget-priced rocking or swiveling insulator disconnects, you may be saving on initial costs, but you are still losing the load switching capability you need. With these disconnects, or with rotating insulator disconnects, you will be paying *with trouble*—when you try to drop full load or when you try to open a heavily loaded loop.



LOAD INTERRUPTERS



Closeup view of S & C Alduti Load Interrupter (side-break style), 14.4 kv rating. May be mounted vertical, upright, or inverted.

For full information about the S & C Alduti (side-break style) and other S & C Load Interrupters, write for Catalog Section 760, S & C Electric Company, 4421 Ravenswood Ave., Chicago 40, Illinois. In Canada: S & C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

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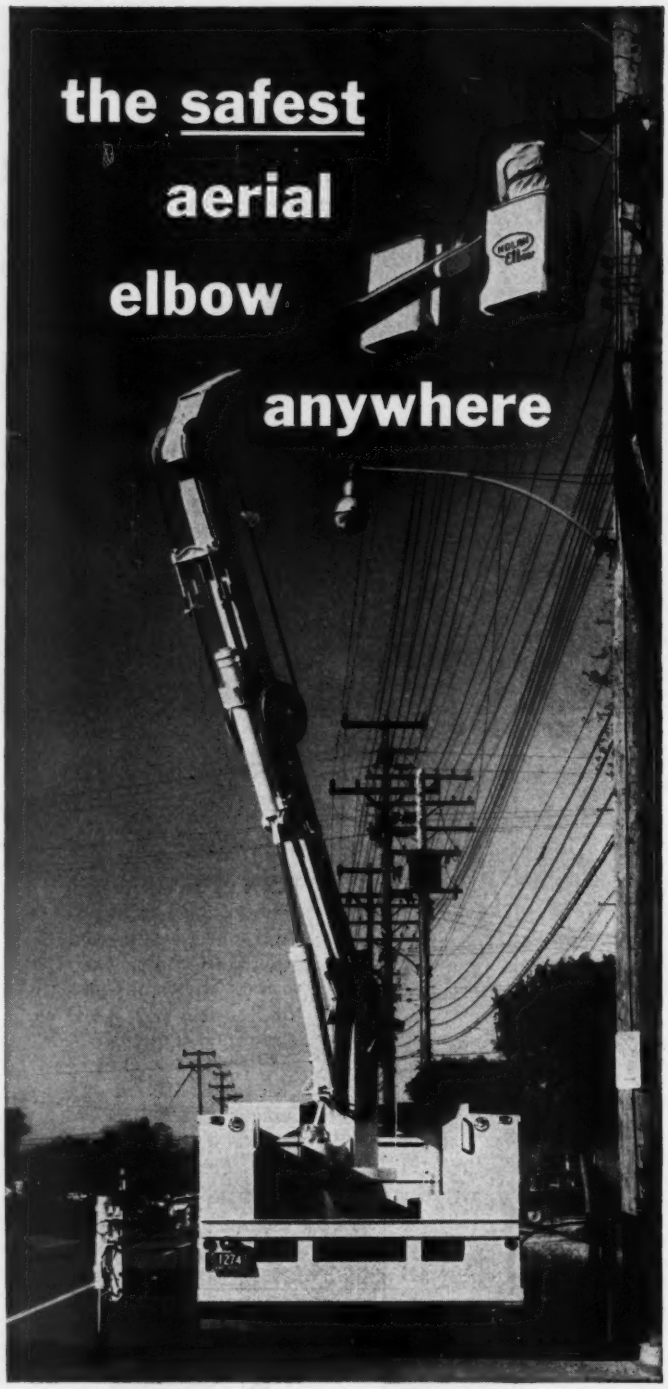
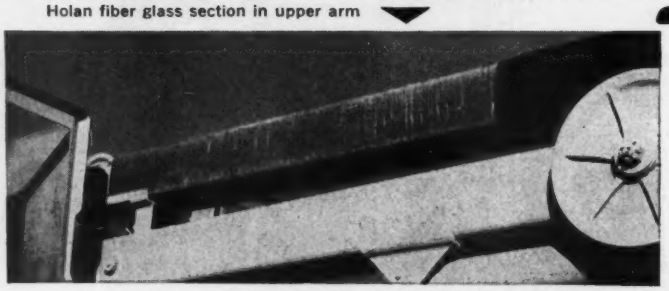
Power Fuses
Metalclad Switchgear



Holan fiber glass section in upper arm



Holan Elbow has precise aircraft-type cable controls and strong, non-conductive fiber glass section in upper arm

With a Holan Elbow, it's easy to get to the problem—and safe when you get there.

The exclusive cable control system provides easy, precise spotting of the buckets. And a fiber glass section in the upper arm insulates workmen in the buckets from the ground. In a bucket-to-ground test, the non-conductive fiber glass section withstood 100,000 volts for one minute.

As for strength, in a separate test the fiber glass section required a 6,200-pound load at end before failing. This is a safety factor in excess of 7 as nominal capacity and weight of the buckets total 800 pounds.

Safety does come first but there are many operating features to talk about, too. Write for all the details.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

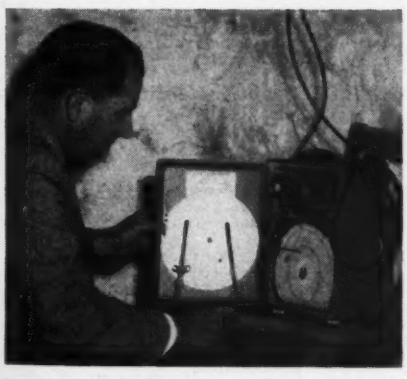
Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

NEW BRISTOL 3-PEN AMMETER ideal for checking balance in 3-phase system.

1-, 2-, now 3-pen Bristol Ammeters



EXTREMELY COMPACT, the Bristol 641 "folded-chart" ammeter is available in 1- or 2-pen models.

You can record up to 3 related or independent currents on one Bristol instrument (similar voltmeters available)

Bristol's recording ammeters now can have as many as 3 independent moving iron elements.

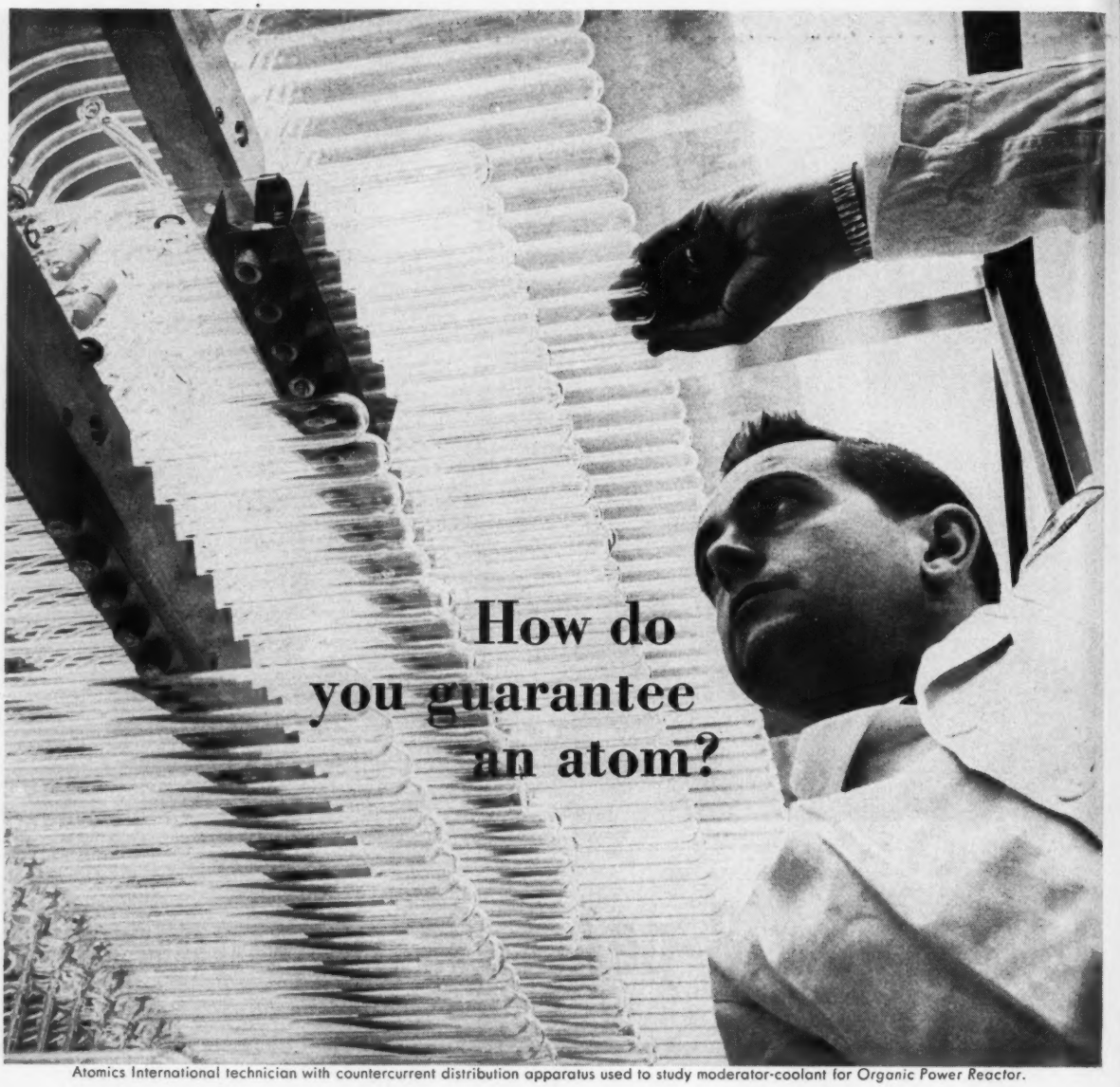
These are the same rugged, stable, high torque, low burden elements that have earned Bristol ammeters such a reputation for accuracy and dependability on utility and industrial applications. For fixed installation, ammeters come in models for flush-panel mounting, surface-panel mounting or interchangeable surface or flush-mounting with either terminal stud or conduit connections. Units also come in a portable model and a portable or pole mounting model. And look at these big features:

Accuracy—1% of scale.
High actuating torque—gives positive recording. Leveling not critical.
Low electrical burden—5VA at 5 or 10 amps.
Stability of calibration—field calibration (seldom required) easily done without special skill or tools.
Rugged construction—shock proof bearings. Pen locks for transport.

Write for complete data on Bristol 1-, 2-, or 3-pen recording ammeters or voltmeters. The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

8.11

BRISTOL TRAIL-BLAZERS IN PROCESS AUTOMATION
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



Atomics International technician with countercurrent distribution apparatus used to study moderator-coolant for *Organic Power Reactor.*

Begin with the knowledge of experienced scientists... conduct a seven-year research and development program ...collect a wealth of solid operating experience. Result: GUARANTEED PERFORMANCE of a nuclear power reactor, designed by Atomics International to help meet the world's power needs.

This is the ORGANIC POWER REACTOR—outgrowth of research and development on the organic system and operation of the Organic Moderated Reactor Experiment (OMRE) conducted by Atomics International for the U.S. Atomic Energy Commission.

Outstanding advantages of the ORGANIC POWER REACTOR: Low capital investment • Low cost operation • High inherent safety and flexibility • Reliability resulting from

- **Non-corrosive moderator coolant**
- **Low pressure system**
- **Conventional, off-the-shelf components and materials**
- **Easy access during operation**

Atomics International is ready to furnish complete ORGANIC REACTOR electric power plants, including fuel elements, in a wide range of power levels. An experienced field staff will assist with initial plant operation, personnel training and maintenance procedures.

For details contact: ATOMICS INTERNATIONAL, Canoga Park, California, U.S.A. Cable address: ATOMICS.

ATOMICS INTERNATIONAL
A DIVISION OF NORTH AMERICAN AVIATION, INC.
PIONEERS IN THE CREATIVE USE OF THE ATOM

Other offices in: Washington, D.C., U.S.A.; Geneva, Switzerland, Affiliated with: INTERATOM, Bensberg/Cologne, Federal Republic of Germany

485-ft Towers Built to Cross Columbia River

Two giants are part of 7-tower line built by Pacific Power & Light to carry 115-kv line across river

You don't often see transmission towers as tall as the two 485-ft whoppers completed in recent months by Pacific Power and Light Company. Located just west of Vancouver, Wash., they are the most spectacular structures on a two-mile line spanning the Columbia River (about 2400 ft wide at this point), Hayden Island, and the 1000-ft-wide Oregon Slough. The 115-kv line brings power from the utility's expanding Lewis River hydroelectric projects into the Portland, Ore., load center.

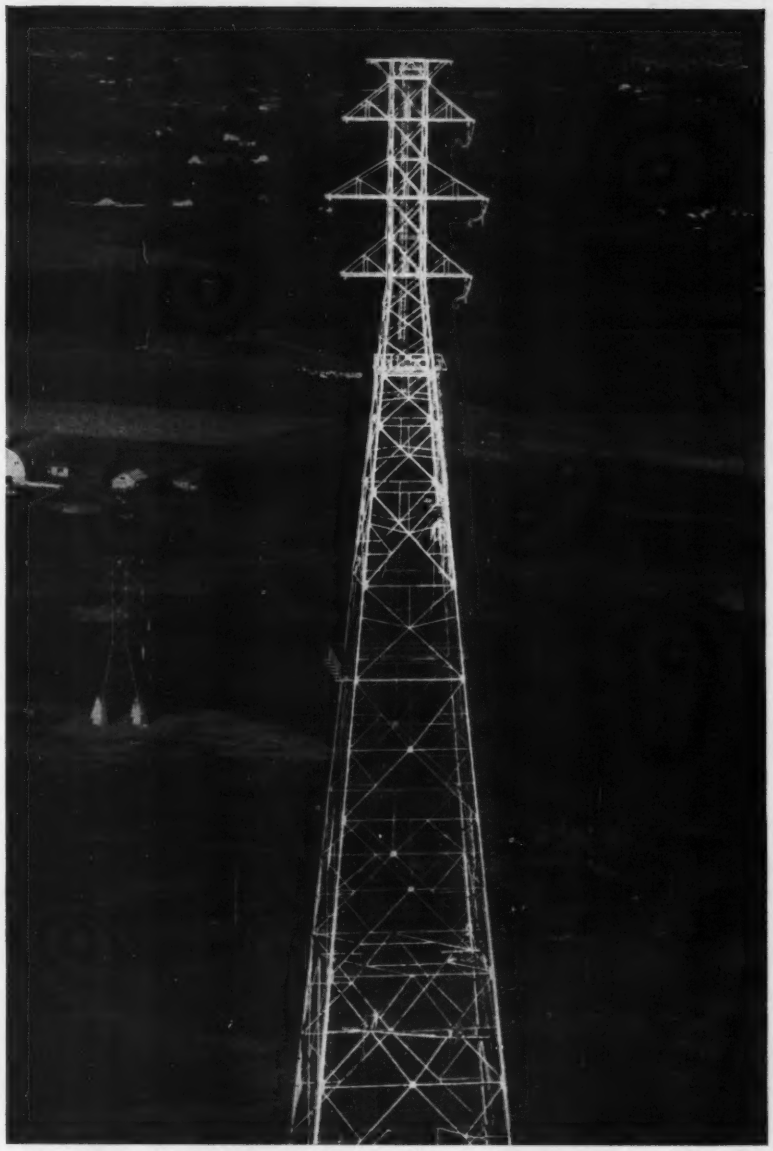
3300-FT SPAN . . . The two tall towers, one located on the Washington (north) shore and the other located on Hayden Island, are 3300 ft apart. The lowest of the three conductors clears the river by 221 ft, the single shield wire by 305 ft. The conductors are about an inch in diameter—795 MCM ACSR 2/67 "Drake," 15,000 lb MWT with ½ in. ice and 8 lb wind at 0 deg F. An additional shield wire and three added power conductors are planned for future installation.

FABRICATED AT SEATTLE . . . The seven galvanized steel towers required for the crossing were designed by Bethlehem Pacific, and fabricated at Bethlehem Pacific's Seattle tower shop. In addition to the 485-ft suspension towers, there are two 230-ft suspension and three 100-ft dead-end towers. Steel requirements totalled 600 tons.

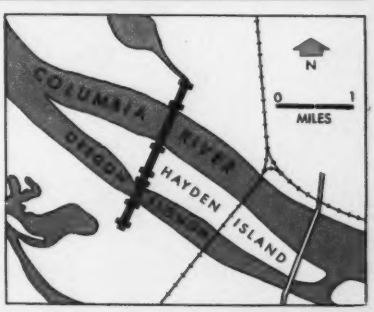
Erection of the towers, as well as stringing of the cables, was handled by Pettijohn Engineering Company, of Portland.

THREE TOWER SHOPS . . . Transmission towers and substation structures of all types are supplied from our three tower shops, each well-equipped to design, detail, fabricate, and galvanize your requirements. On the West Coast, Bethlehem Pacific operates shops at South San Francisco and at Seattle. Our eastern plant is located at Leetsdale, Pa., near Pittsburgh.

If you're planning new construction, we suggest that you contact the Bethlehem sales office nearest you.



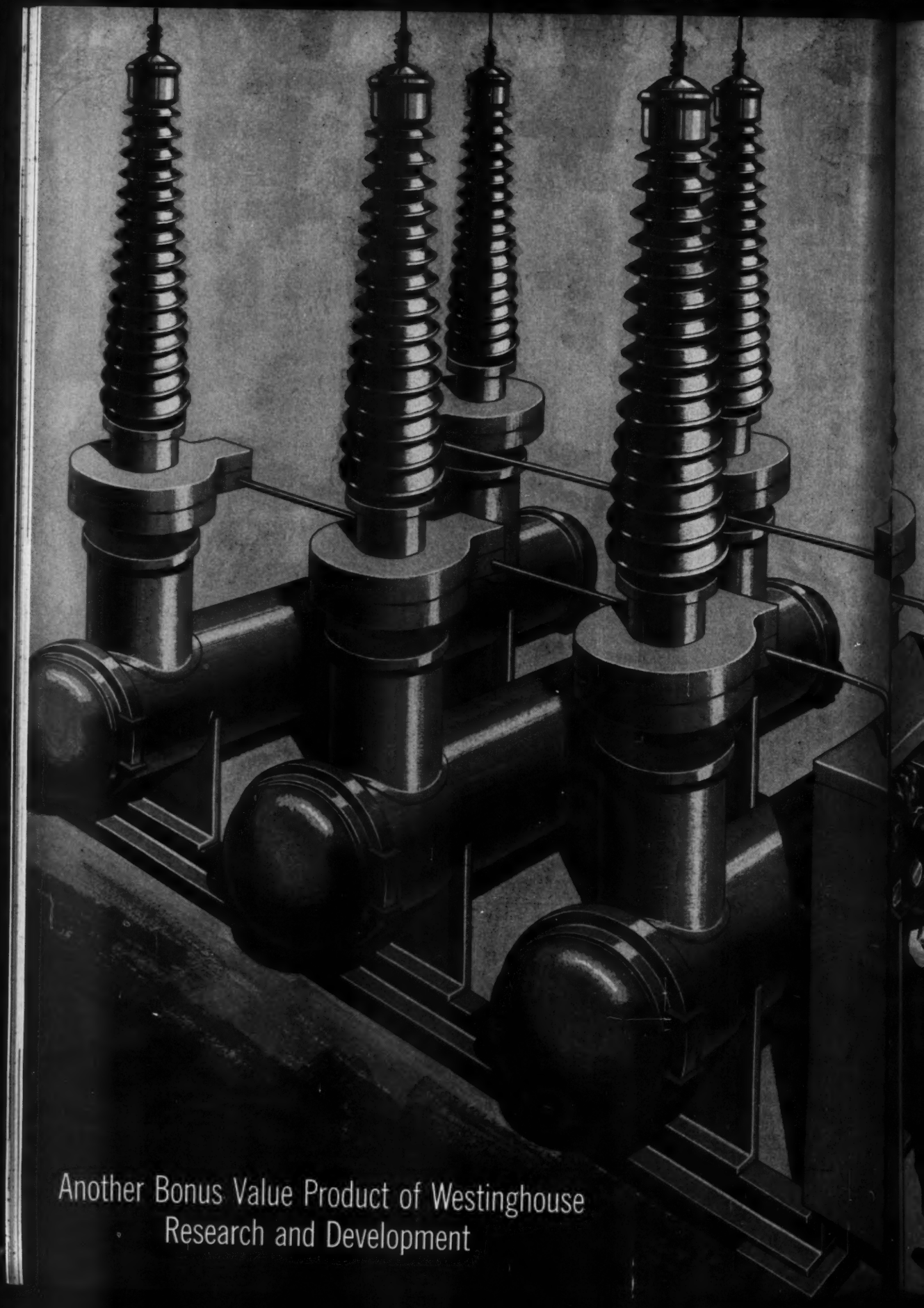
A 485-ft tower on the Washington side dwarfs the 100-ft anchor tower at center-left. Although the tower is galvanized, painting was required by the Civil Aeronautics Authority. A number of painters at work are barely visible in the photo.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL


Another Bonus Value Product of Westinghouse
Research and Development

WESTINGHOUSE ANNOUNCES

New Power Circuit Breaker Using SF_6 Gas

The Only Significant Advance in Circuit Interruption Techniques in Over 15 Years

A revolutionary 230-kv, 15 million-kva, high-capacity circuit breaker, using sulphur hexafluoride (SF_6) as the extinguishing medium, has been developed at the Westinghouse High Power Lab. This new interrupting technique will permit higher breaker ratings and much longer, more economical operating life than present designs.

This unique new horizontally mounted breaker brings the industry many radical design innovations with important savings in installation and maintenance.

Drastically slashes maintenance. This unusually stable gas does not decompose, and thus its life is not the controlling factor in time between maintenance. The interrupter assembly can be easily removed at ground level for inspection and maintenance — no scaffolding is required.

Allows simplified foundations. There is no energy transfer to foundation during interruption. Reduced size and elimination of oil has reduced weight of 230-kv gas breaker by 65 percent.

Dead tank construction provides complete safety.

Inexpensive, overlapping protection with bushing-type current transformers available on both sides of breaker.

Quiet operation. The breaker has a closed gas system, thus no discharge to atmosphere, which keeps the noise to a level comparable to the oil breaker. The closed system also conserves gas and prevents contamination.

The outstanding advances in this new breaker design are made possible because of the unusual characteristics of sulphur hexafluoride gas as an extingiushing medium:

SF_6 rapidly recovers dielectric strength because of exceptional affinity for electrons . . . assures unexcelled arc extinction.

SF_6 is extremely stable . . . thus assuring long life of the insulating and interrupting medium.

SF_6 has high dielectric strength . . . at only 10 psi, it is equivalent to oil or to compressed air at 150 psi.

SF_6 is nonflammable . . . completely safe for crowded urban substations.

SF_6 is inert, nontoxic and odorless.

This new 230-kv breaker is the first of a complete line of high-capacity SF_6 breakers. To learn how SF_6 can bring new economies to your system, call your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P.O. Box 868, Pgh. 30, Pa.

J-60962

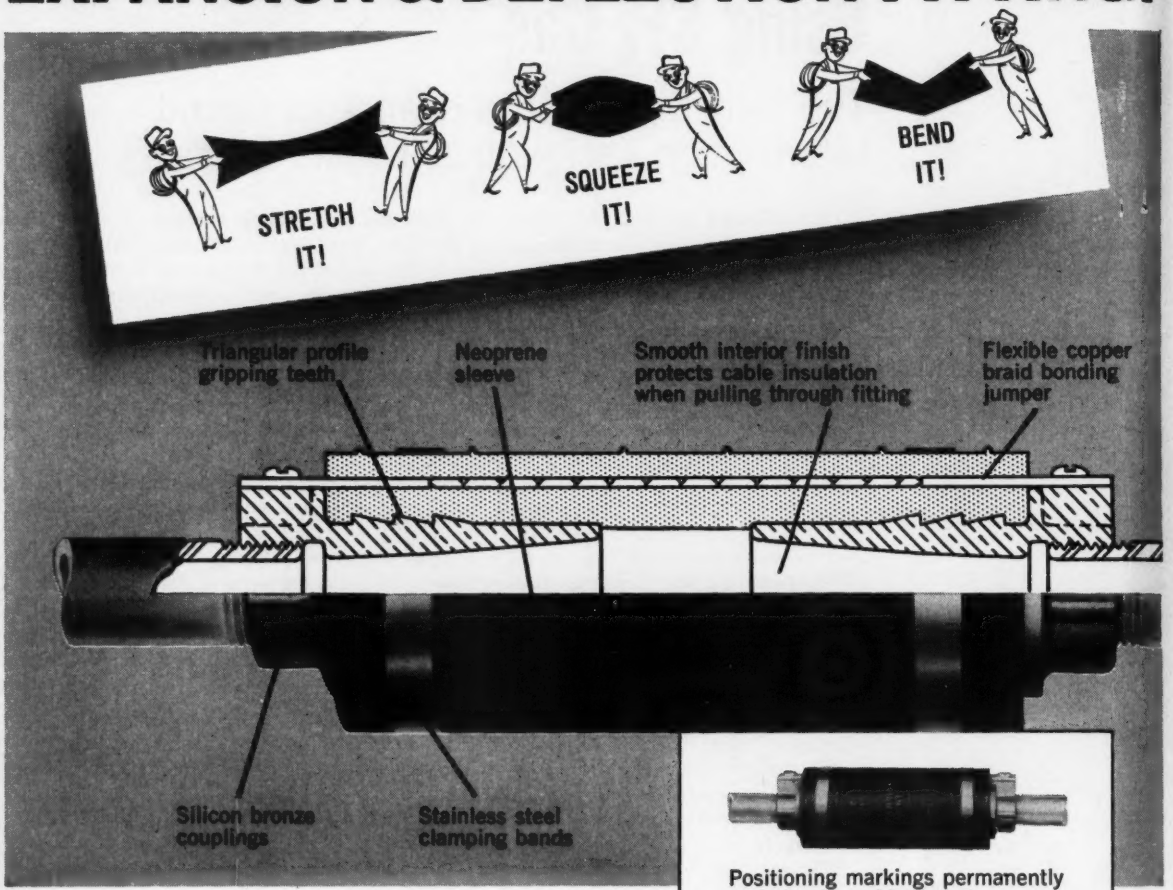
YOU CAN BE SURE... IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS" CBS TV MONDAYS

R. C. Boyd, R. E. Friedrich and B. P. Baker inspect the interrupter components of the new SF_6 breaker. A high-velocity flow of gas is directed through this formed Teflon orifice to extinguish the arc.

For Positive Freedom of Conduit Movement—

THE ALL NEW O.Z. TYPE "DX" EXPANSION & DEFLECTION FITTING!*



Here's the newest addition to a long line of O.Z. expansion and deflection fittings — the O.Z. Type "DX"! Of completely new design and construction, it provides fitting features *never found before!*

The all-new Type "DX" is designed principally to compensate for expansion, contraction, and deflection in conduit across expansion joints in concrete, but it also may be used as a vibration damper.

For more information on this rugged, corrosion-proof, Weathertight fitting, call your local O.Z. distributor or write direct to the company.

Positioning markings permanently and clearly molded on sleeve assure proper placement of fitting in expansion joint

- **Compensates for expansion, contraction, deflection; may be used as a vibration damper.**
- **¾" expansion and contraction movement.**
- **30° angular deflection from the normal in any direction.**
- **Corrosion-proof!**
- **Weathertight!**

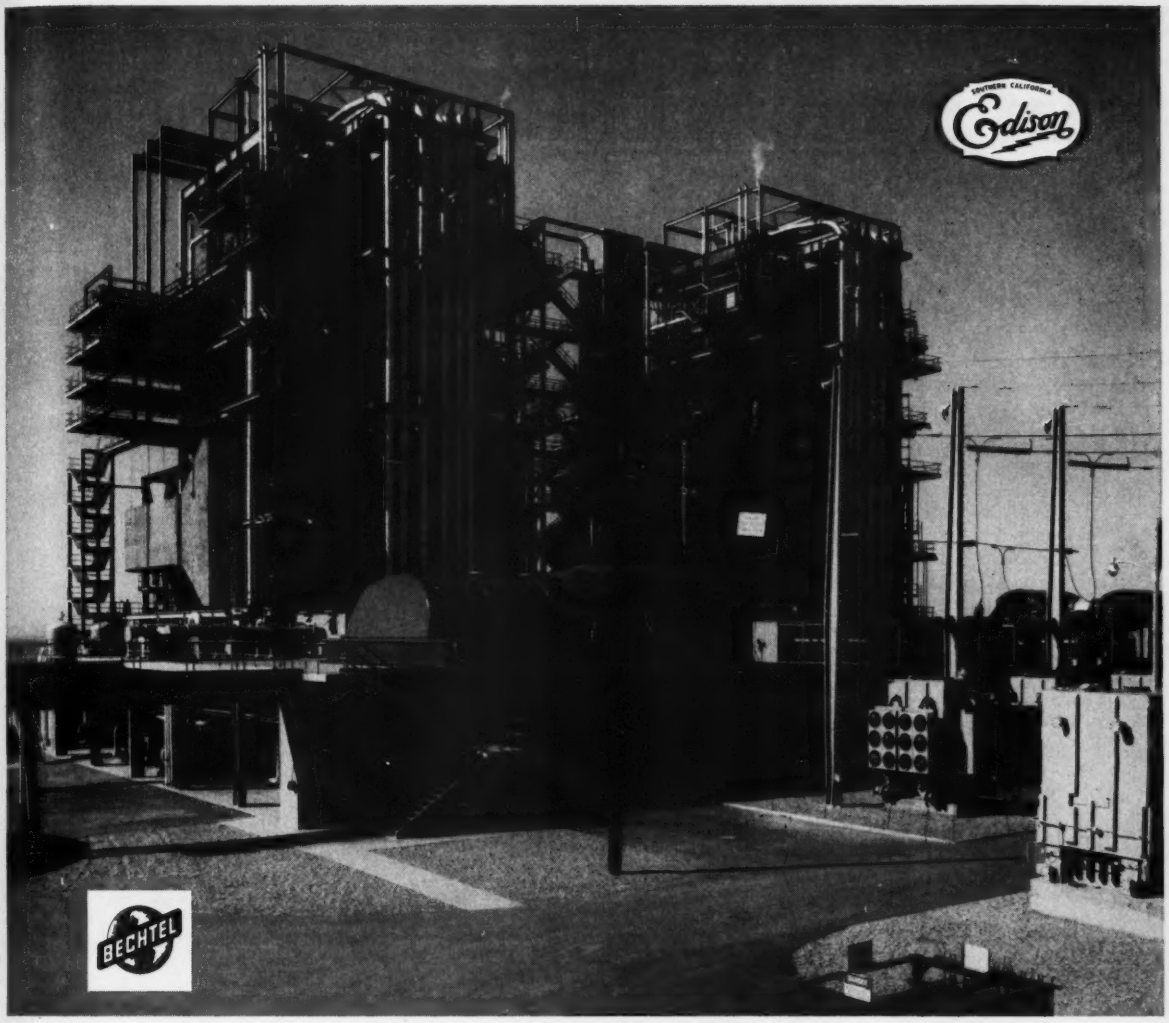
*Patent Pending

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846



HUNTINGTON BEACH PACES EDISON'S GROWTH CURVE

The new Huntington Beach Steam Plant of Southern California Edison Company exemplifies the forward-looking policies by which the company contributes so importantly to California's growth.

The plant—with a capacity of 400,000 kilowatts—meets today's needs and provides for reserve power which will stimulate further growth in this fast-expanding area. First of its two 200,000-k.w. generators—the largest in the West—began producing last year and its "twin" went into operation recently.

Working closely with Edison engineers, Bechtel designed, engineered and constructed the Huntington Beach plant—one of several important projects Edison initiated or completed in 1958 in an expansion program involving approximately $150 million.

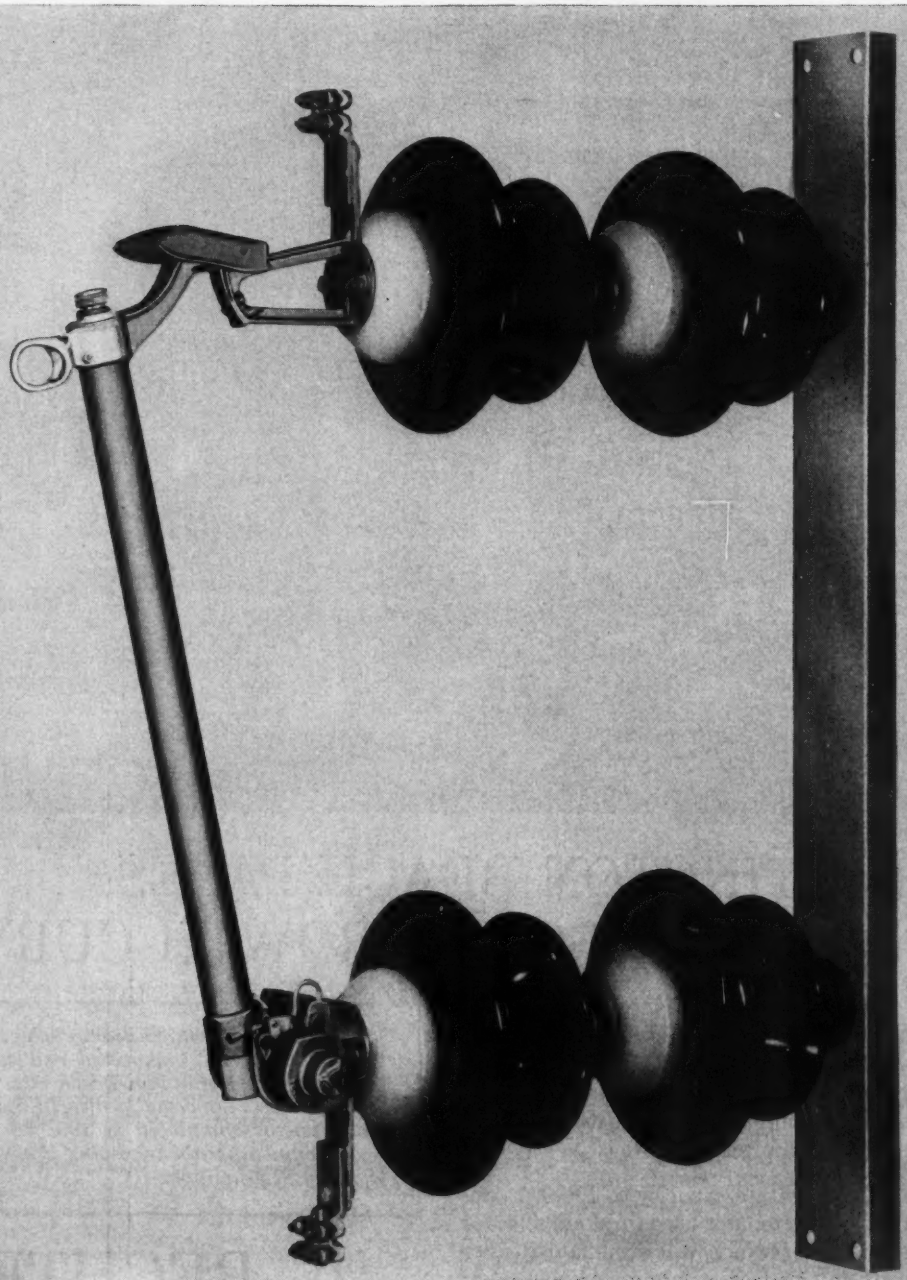
BECHTEL CORPORATION

Engineers and Builders for Industry

SAN FRANCISCO • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED Toronto

An Economical New Family of Po



THE POWER FUSE

THE POWER FUSE

New full color sound movie on power fuses now available to any interested activity

Here is the dramatic story of the Power Fuse told in 25 minutes, including animated illustrations, actual field tests, and engineering data. Factual, up-to-date, informative. For a private showing, contact your Southern States representative or write direct to the company. (16 mm, color, sound.)

ofPower Fuses by Southern States

- LOW INITIAL COST— LOW RE-FUSING COST
- INTERCHANGEABLE FUSE HOLDERS
- WIDEST SELECTION OF RATINGS
- SIMPLIFIED CONSTRUCTION

Engineers charged with the dual responsibility of adequate system protection at minimum cost will welcome this new family of Southern States Power Fuses—the greatest development in years!

The simplified design and construction of these powerful, reliable fuses result in immediate savings on initial costs, when compared with most other types.

Re-fusing in the field results in remarkable savings: For example, at 69 kv a comparative cost for re-fusing a 3-phase installation shows a price differential ranging as high as $422.00. Higher voltages reflect even greater savings.

When system demands increase, and higher ratings are needed, it is a simple matter to change fuse holders—using existing mountings—and thus reap additional savings.

The costly practice of applying a fuse with excessive interrupting capacity is no longer necessary. The widest possible selection of fuses in this new Southern States family permits fusing to meet exact requirements. Substantial savings, without sacrifice, can be made here!

With interrupting ratings approaching 3½ million kva at 161 kv, it will pay everyone concerned with power fuses to investigate this new family of power fuses. Contact your Southern States representative, or write direct for Technical Bulletin 59PF.

COMPLETE FUSE KITS AVAILABLE

Clearly marked fuse kits are available at low cost for re-fusing Southern States Power Fuses *in the field*, easily and quickly. All components are sealed in moisture-free polyethylene bags. Kits are available in four speed ratios: PF (slow speed), PM (medium speed), PX (fast speed) and EEI-NEMA Type PE. Time-current characteristic curves are available for all fuses.

PIONEERS IN POWER FUSES SINCE 1924

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

New ORANGEBURG® CA* CONDUIT *with Flush Coupling Attached!*

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

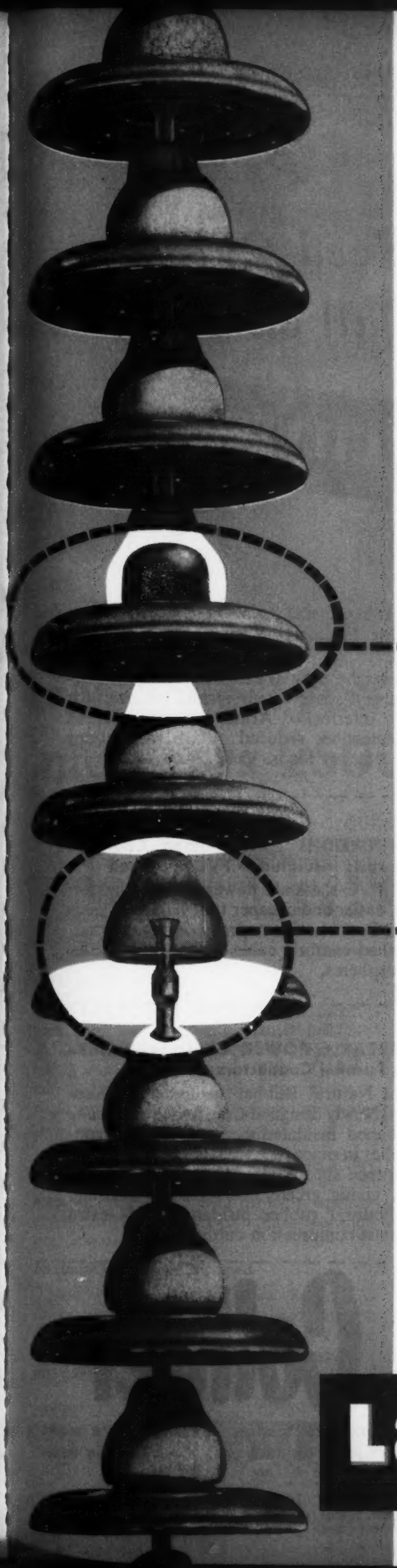
What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EW-39 for Catalog 52.

ORANGEBURG MANUFACTURING CO.
Orangeburg, New York • Newark, California
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.



GOT AN INSULATOR CORROSION PROBLEM?

Competent transmission system design calls for selection of components matched to each other in useful-life-expectancy. It often is the case, in areas of salt spray and/or industrial contamination, that rusting out of suspension insulators may be the first sign of a line "wearing out"—years before conductors or structures are in need of replacement. For such lines now being constructed or planned, the need for high-line maintenance or future reinsulation—and its high cost in skilled labor, transportation, and materials—can be avoided. Lapp suspension insulators are available, on specification, with cap and bolt components in a variety of corrosion-resistant alloys. We now have a lot of test data and installation records to help us, and you, to predict performance of these metal parts over periods of varying conditions of weather, concentration of corrosive action, prevalence of contamination, leakage currents and corona. Ask your Lapp representative about it—or write direct to us.

the porcelain is "forever"

Lapp vacuum process porcelain, with balanced compression-glaze "fit," has been proved—over millions of pieces, in thousands of shapes—the "most dependable insulation material on any system." Suspension discs are offered in standard (15,000-lb.) strength, high (25,000-lb.) strength, and heavy-duty shells. Fog-type units in same standard and high strength ratings, for either 5¾" or 6½" spacing.

the hardware by specification

FORGED STEEL hot-dip galvanized, standard for caps and bolts. Smooth contours and uniformity of galvanizing have improved corrosion resistance over earlier insulators.

MALLEABLE IRON for caps only. Hot-dip galvanized, it is approximately equivalent to standard forged steel in corrosion resistance.

LOW-ALLOY STEEL hot-dip galvanized. For caps and bolts. Offers four to six times greater resistance to corrosion than forged steel. Nominal price premium.

DUCTILE NI-RESIST for caps only. Considerably lower in cost than stainless, is second only to stainless in resistance to most forms of atmospheric corrosion.

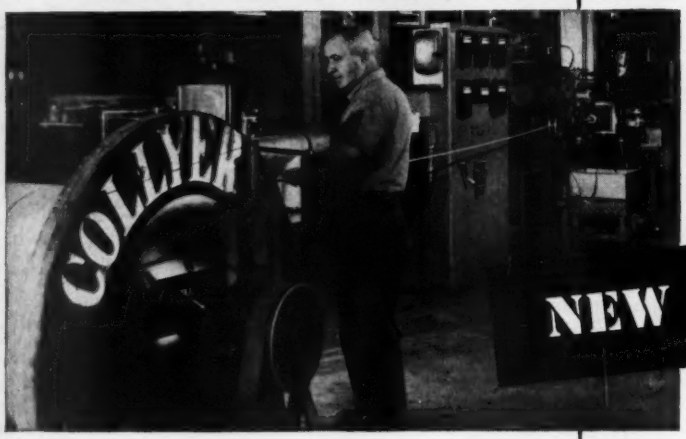
STAINLESS STEEL has highest resistance to corrosion of any material. Used principally for bolts, can be furnished for caps where severity of operating conditions justify the cost.

ALUMINUM-SILICON-BRONZE for caps and bolts under special chemical atmospheres where its resistance exceeds that of stainless.

Lapp

Lapp Insulator Co., Inc., LeRoy, New York.

One of Collyer's new thermoplastic insulating machines in our new separate department devoted exclusively to the application of high-quality thermoplastics to conductors and assemblies. Facilities include latest equipment for automatic and continuous control of extruding temperatures and dimensions . . . precise let-off and take-up controls to insure uniform product quality.



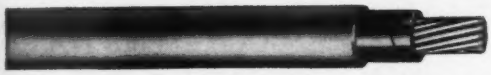
Need Cable? Call on Collyer!

NEW FACILITIES

NEW CABLES

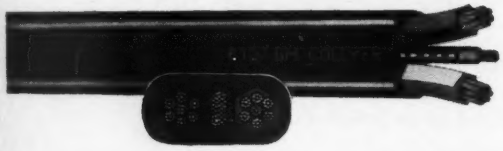
NEW INTERLOCKED ARMOR Cable — Varnished Cambric Insulated — Aluminum or Steel Armored

Flexible, lightweight, easy to handle — cuts installation time, cost and space requirements. No need for rigid conduits. Interlocked Armor assures excellent mechanical protection, reduced outage, continuous operation under heavy loads. Voltages to 15,000.



NEW LIGHTWEIGHT PVC-Sheathed Cable — Varnished Cambric Insulated — PVC Sheathed

Versatile new PVC-sheathed power cable is lighter, less expensive, easier and cheaper to install than lead-sheathed cable. Better moisture protection than braid-covered varnished cambric cable. High resistance to corrosive atmospheres.



NEW PORTABLE POWER Cable with HEX-SHAPED Twin Parallel Conductors —

Heat Resistant Natural Rubber Insulated — Neoprene Sheathed Newly designed *Coal Mining Machine Cable*. Hex-shaped insulated conductors lock conductor assemblies in place to give cable longer flexing life. New Neoprene sheath compound is tougher and more durable, giving greater resistance to abrasion and tearing. Natural rubber insulation adds extra protection against compression cutting.

New Collyer facilities! New Collyer products! Added evidence that Collyer is ready to supply the needs of the electrical industry. Wherever cable must meet highest construction and service standards, it pays to "Call on Collyer." Let us quote on your specific requirements. Write **Collyer Insulated Wire Co., 247 Roosevelt Ave., Pawtucket, R. I.**

LIVE BETTER ELECTRICALLY

Collyer

POWER CABLES • CONTROL CABLES • SWITCHBOARD WIRES
SERVICE CABLES • SERIES LIGHTING CABLES • BUILDING WIRES

L-M Kyle Type E 23 KV Recloser Now Interrupts 2500 Amps; Other Changes

More precise hydraulic mechanism; finger-tip choice of sequences; simplified contact construction permits conversion from 2.3 to 23 kv without changes.

By **LYLE McNULTY**
Application Engineer, Kyle Reclosers
Line Material Industries

L-M's Type E power class recloser has recently been improved to provide greater flexibility and convenience, a wider range of applications, higher interrupting capacity. Three Type E's may be electrically interlocked to provide 3-phase lockout when any one phase locks open.

Higher Interrupting Capacity

The Type E now provides interrupting ability 40 times coil rating, with a maximum of 2500 amperes, symmetrical, over the entire application range from 2.3 to 23 kv, without any addition or removal of parts.

Sequences Easily Changed

New, more precise and more versatile hydraulic mechanism. Improved timing control. Finger-tip choice of sequences. These can be changed in the field without special tools or any parts.

Simplified Construction

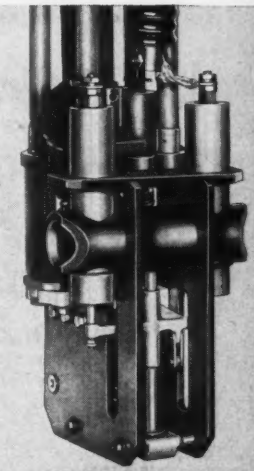
Contact buffer assembly simplified. No changes are necessary to convert from 2.3 to 23 kv in the field. Two identical contact tubes simplify maintenance, cut maintenance costs.

Improved Arc Extinction

Arcing chambers designed to give quick interruption with minimum of arc energy at high fault currents, and to provide supplementary oil turbulence required for lower fault currents.

Get Complete Information

The new Type E provides the same high-quality performance that has made Kyle Reclosers the undisputed leaders in the field. Ask the L-M Field Engineer for Bulletin CR1B on the New Type E, and information on other Kyle Reclosers, including Kyle-Klad equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

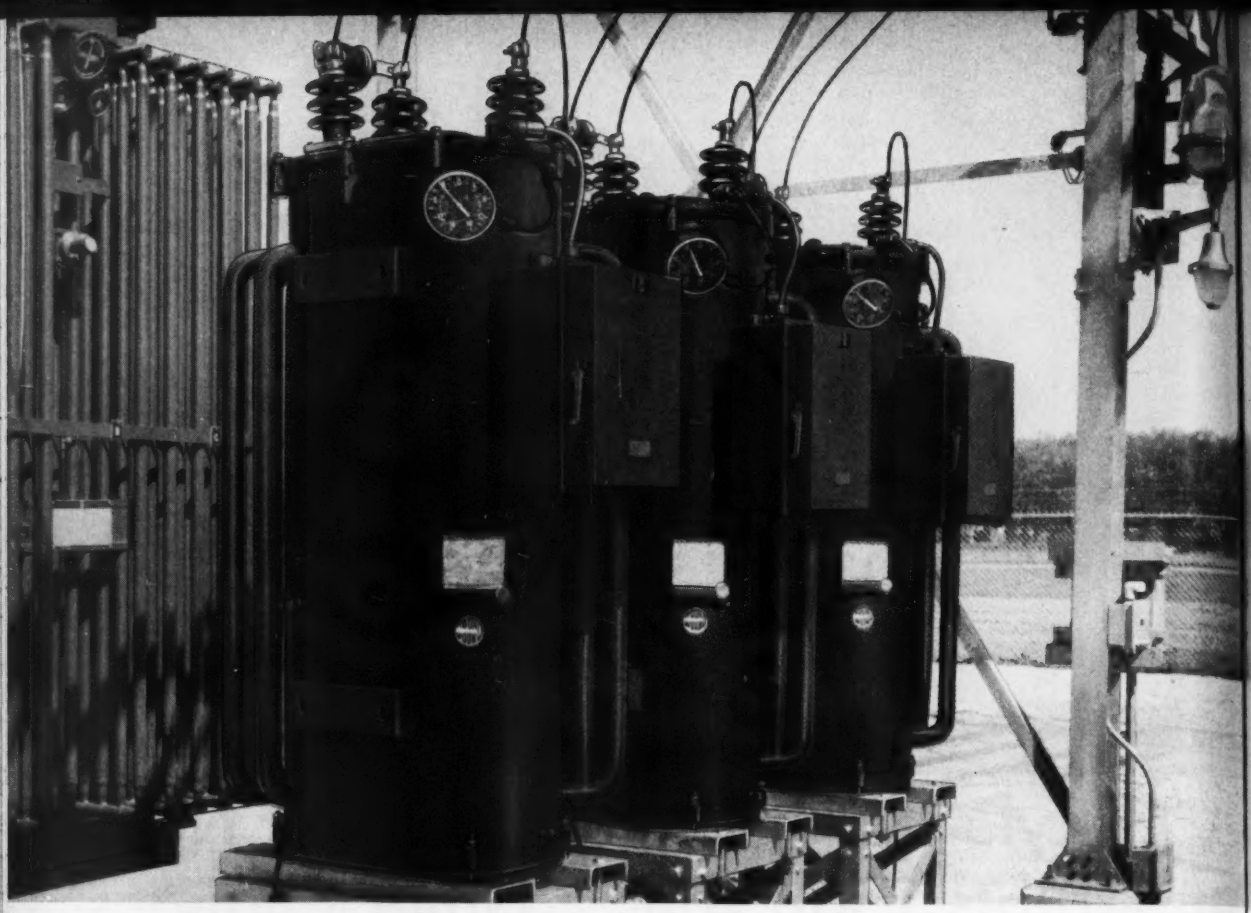


THE NEW HIGHER-CAPACITY arc-interrupter mechanism handles up to 2500 amperes at 23 kv. Two vented arcing chambers. Double break contacts driven by toggle spring to insure rapid opening and closing. Moving contacts have separate load transfer and arcing surfaces to insure long wear.

LINE MATERIAL® Industries Kyle® Reclosers
McGRAW-EDISON COMPANY

389

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



L-M 32-STEP 7620 VOLT REGULATORS installed in a middle-western substation. Note the easily accessible control and easy-to-read position indicator.

The dial is tipped down to permit easy reading from the ground when regulator is pole- or platform-mounted.

L-M Announces New Ratings, New Tap Changer In 32-Step Regulator

New ratings are 300 and 400 amperes at 2500 volts; 219 amperes at 7620 volts. These are in addition to 12 ratings in 25 to 200 amperes previously offered.

By **N. K. DELANEY,** Product Manager
Capacitors and Regulators
Line Material Industries

L-M is now offering three new sizes of the Type RSD 32-step Regulators. Five more sizes available soon. All sizes include new, highly effective tap changer, and redesigned, very accurate control mechanism.

L-M RSD Regulators are designed for pole, platform, or substation application. They offer many outstanding features. Some of these are:

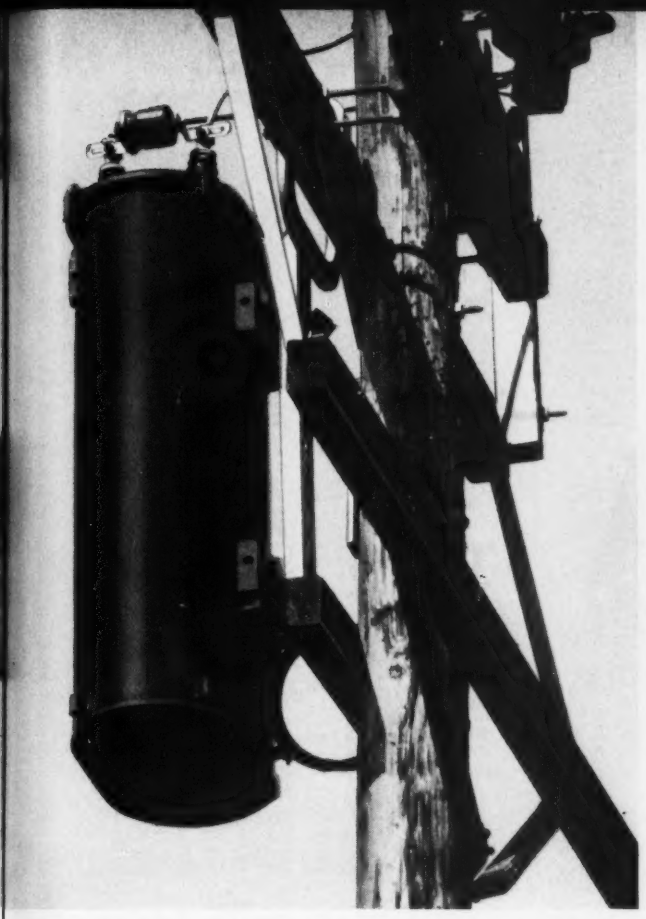
- Operation range plus or minus 10% in 32 5/8%-steps.
- Round-Wound core-coil assembly with low losses and high short-circuit strength.
- Add-Amp feature makes it possible to increase current capacity on the present line up to 160% of normal by reducing range of regulation to 5%.
- Compact design, small size, and light weight are marked advantages for pole mounting. (See Table.)
- Inspection and maintenance are simplified by cover suspension of the complete internal assembly—making untanking easy.

Ask for Information File, Bulletins

L-M Field Engineers make available a file of information on Regulator Application and on L-M RSD Regulators. Ask the Field Engineer who calls on your company for this data; or write Line Material Ind., Milwaukee 1, Wis.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



All ratings can be substation or platform mounted. All but the 7620 volt, 328 ampere rating can be pole mounted. Obround design and light weight reduce the bending moment on the pole. The compact design reduces the height—very desirable for pole mounting. For example, the 7620 volt 219 ampere L-M RSD is only 83 inches high, ten to fifteen inches lower than other makes. It weighs only 2800 pounds, compared with 3000 and 4000 pounds for others. For additional height in substation mounting, elevating structures are available, adjustable in height from 24″ to 36″ or 36″ to 48″.

Look at All Three! You'll Choose the L-M Type RSD

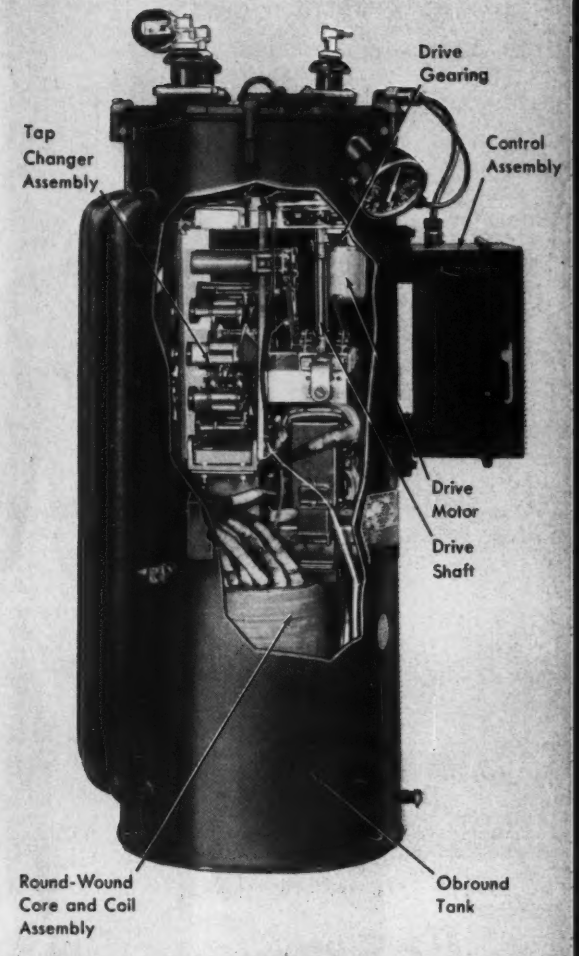
Comparative bushing terminal heights and weights of three well-known makes:

Rating		Terminal Height, Inches			Net Weight, Pounds		
Volts	Amperes	L-M	Brand B	Brand C	L-M	Brand B	Brand C
2500	300	72	78	87	1615	1650	2250
2500	400	75	97	76	1810	3050	3100
7620	219	83	98	93	2800	3090	4000

All L-M sizes can be pole mounted. Only the 2500 volt, 300 ampere sizes of Brands B and C can be pole mounted.

Ratings Now Available		Ratings Available Soon	
Volts	Amperes	Volts	Amperes
2500	100, 150, 200, **300*** and **400***	2500	500 and 668
5000	50, 100, 150, and 200	5000	250 and 334
7620	25, 50, 75, 100, 150 and **219***	7620	328

**New Ratings*



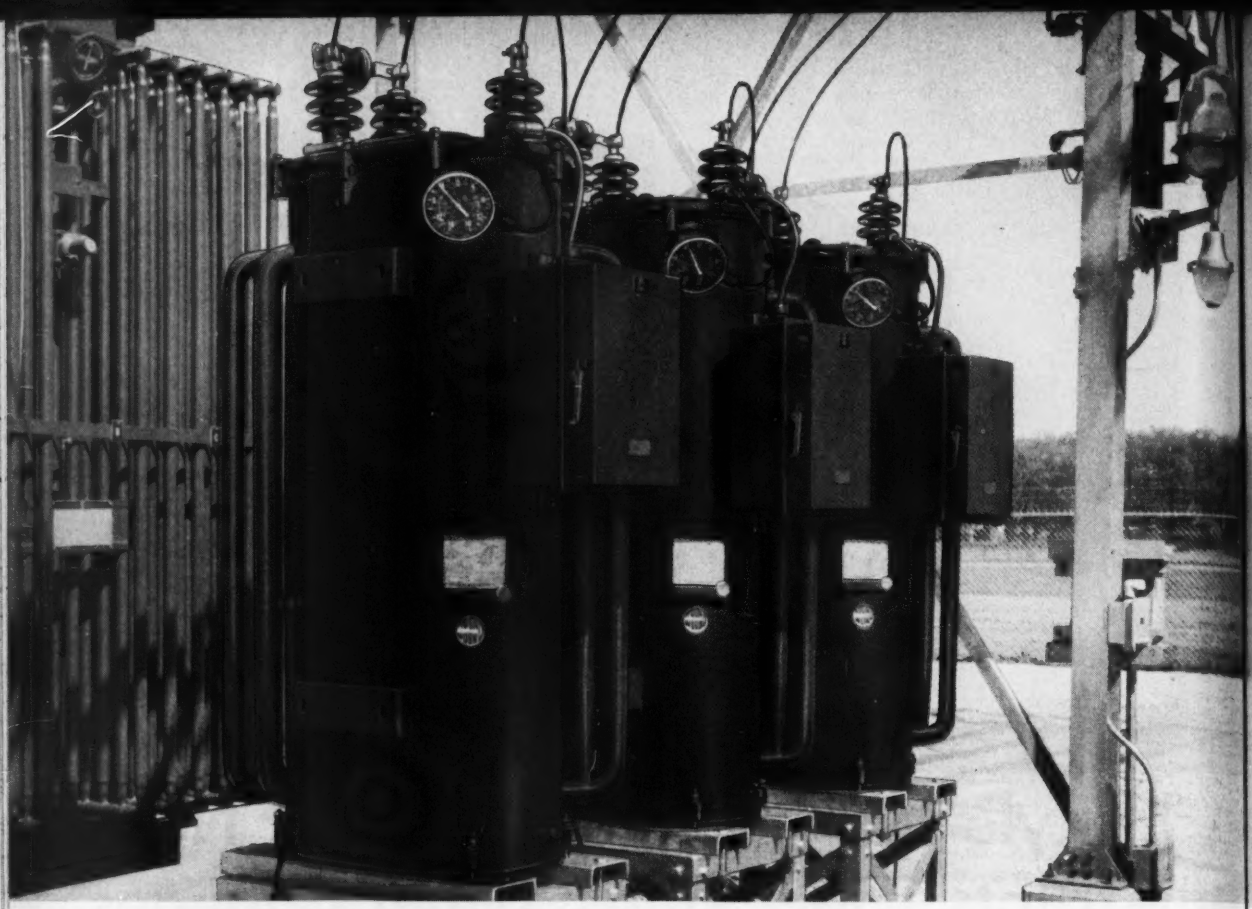
INTERNAL CONSTRUCTION of the RSD Regulator. The whole unit is suspended from the cover to simplify untanking, which makes inspection and maintenance easier. Core-coil assembly at the bottom is L-M's exclusive Round-Wound design, which provides ample cooling, correspondingly higher overload capacity; balanced performance with low copper and core losses and low exciting current; high short-circuit current capacity.

Outstanding new tap changer. Capacitor motor; direct drive mechanism through geneva gear and scroll cam, to cam followers that provide accurate positioning of movable contacts. Two sets of movable and stationary copper-tungsten contacts which are very resistant to arc erosion. Contacts have maximum rating of 668 amperes continuous.

Regulators

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



L-M 32-STEP 7620 VOLT REGULATORS installed in a middle-western substation. Note the easily accessible control and easy-to-read position indicator.

The dial is tipped down to permit easy reading from the ground when regulator is pole- or platform-mounted.

L-M Announces New Ratings, New Tap Changer In 32-Step Regulator

New ratings are 300 and 400 amperes at 2500 volts; 219 amperes at 7620 volts. These are in addition to 12 ratings in 25 to 200 amperes previously offered.

By **N. K. DELANEY**, Product Manager
Capacitors and Regulators
Line Material Industries

L-M is now offering three new sizes of the Type RSD 32-step Regulators. Five more sizes available soon. All sizes include new, highly effective tap changer, and redesigned, very accurate control mechanism.

L-M RSD Regulators are designed for pole, platform, or substation application. They offer many outstanding features. Some of these are:

- Operation range plus or minus 10% in 32 5/8%-steps.
- Round-Wound core-coil assembly with low losses and high short-circuit strength.
- Add-Amp feature makes it possible to increase current capacity on the present line up to 160% of normal by reducing range of regulation to 5%.
- Compact design, small size, and light weight are marked advantages for pole mounting. (See Table.)
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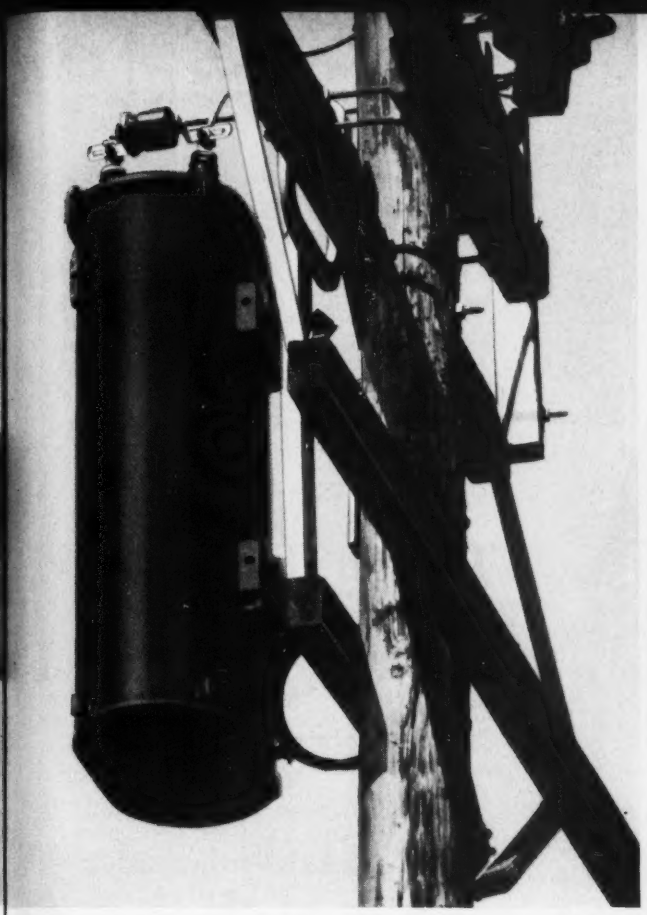

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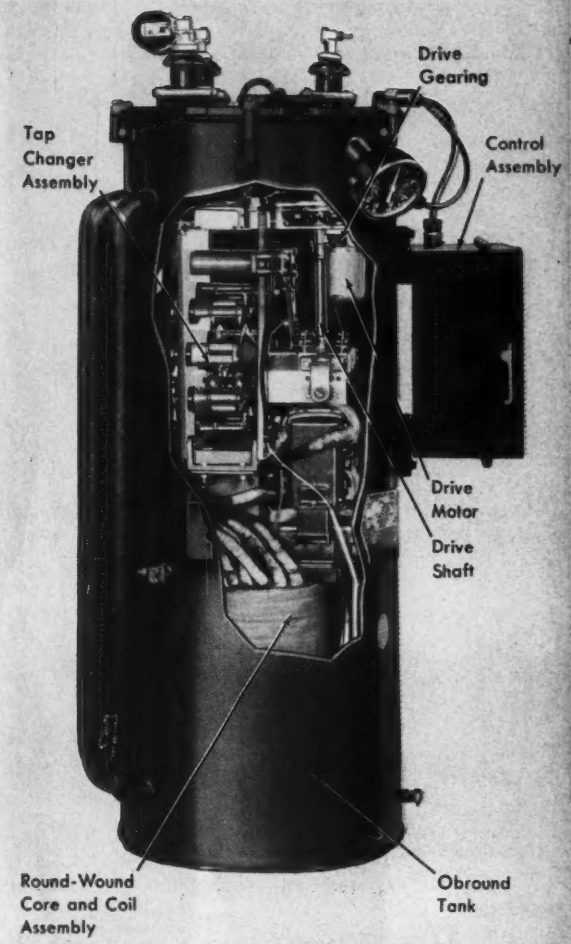

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THIS IS THE IMAGE OF CF&I ...MAKER OF STEEL

He's a giant steelman. He makes good steel and steel products for the diversified needs of today's economy. He anticipates tomorrow's requirements. He is constantly improving products through research and new manufacturing techniques.

His steel mills extend across the country. In them, he guards every step of manufacturing by rigid quality controls. And in his national network of offices and warehouses, he not only *sells* steel products, but he *serves* their users in every possible way.

He is the dynamic image of CF&I . . . the symbol of dependable steel products. Look for him when you buy.

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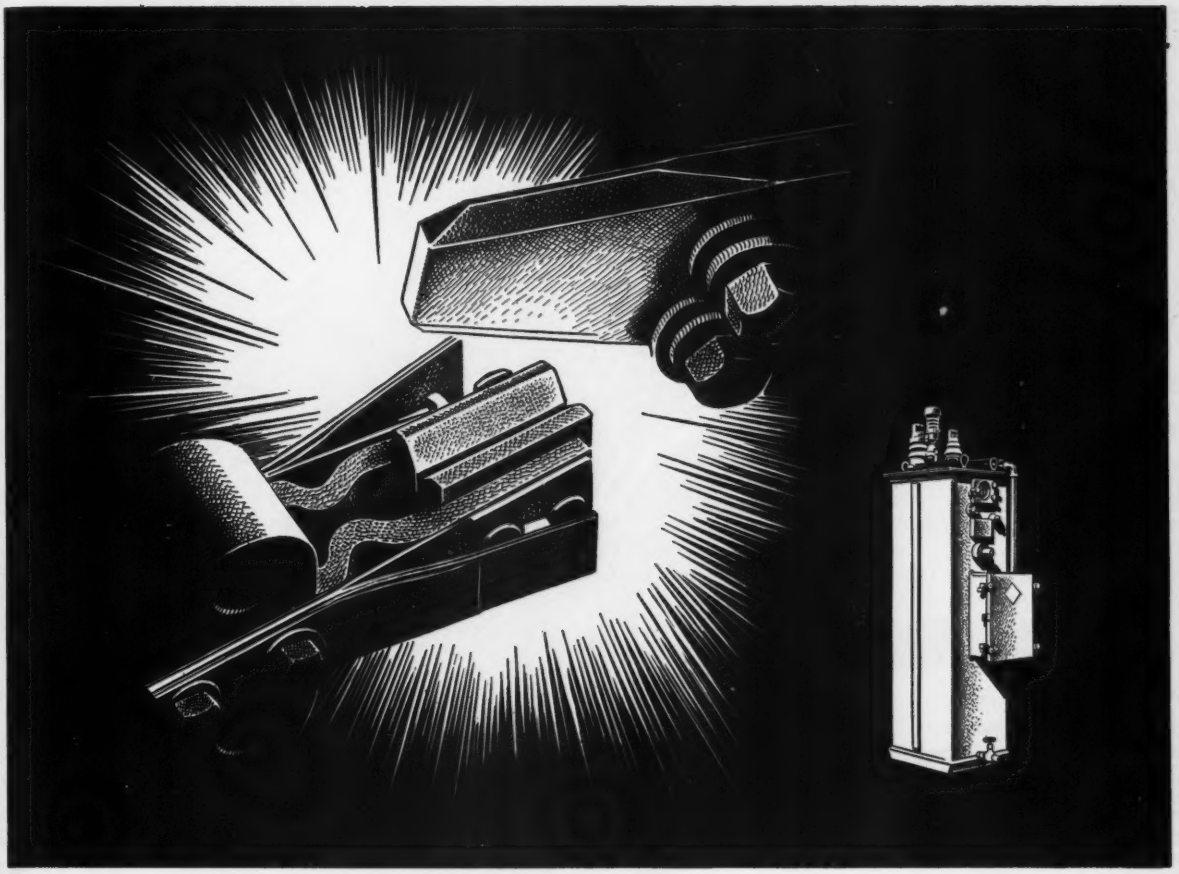

Top Performance Comes "Built-In" When You Specify Mallory Contacts

Contacts play an important role in modern electrical gear such as circuit breakers, motor controllers, and voltage regulators. To be sure of top performance in the equipment you buy, it pays to specify Mallory Elkonite® contacts.

Long experience in the specialized science of contact design and manufacturing goes into Elkonite contacts. The combination of density, hardness, micro-structure, resistance to arc erosion, mechanical strength, and other vital characteristics is selected to match the requirements of each application. The particle size of the refractory constituent and processing technique are carefully controlled to produce the characteristics required by the finished contacts.

For many years, Mallory has engineered and supplied contacts for leading manufacturers of switchgear. Be sure that the manufacturer from whom you buy uses Mallory Elkonite contacts. They're your assurance of lasting and dependable performance . . . and they're the hallmark of value-minded design.

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
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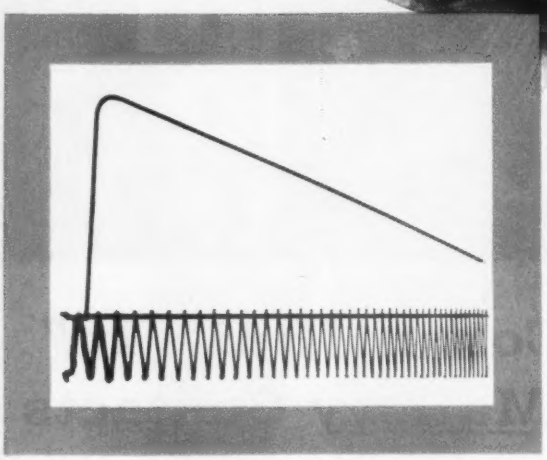
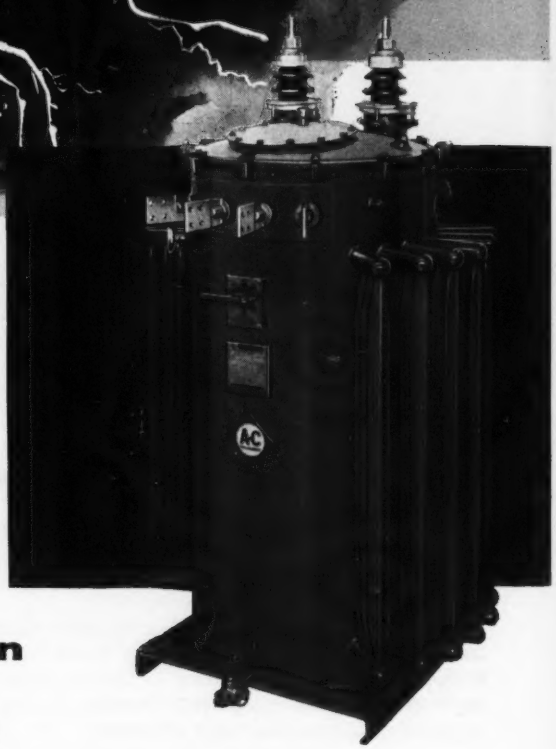
ALLIS-CHALMERS modern line for '59





Insulation strength assured

Automatic fault detector oversees impulse tests of Allis-Chalmers distribution transformers

Even the smallest fault triggers a flashing red light and an alarm bell. Thus the new automatic fault detector eliminates human error in impulse testing. What better assurance that overall insulation strength meets all standards—that insulation will withstand severe lightning and surge conditions!

Every Allis-Chalmers distribution transformer, from 5 to 500 kva, is impulse tested on the production line. The record of operating reliability proves the wisdom of this policy. Call your A-C man for details, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

ALLIS-CHALMERS

A-5906

Editorial Comment

MARCH 16, 1959

Power Grid Proposal Must Be Met

Looking ahead to the expected shenanigans of the victorious politicians in 1959, Electrical World added a new feature column, "Politics and Public Power." As the picture unfolds, it is obvious we were quite timely in allocating this extra space. In fact, we are hard put to find sufficient room to report all the shenanigans spawned thus far.

The most recent scheme the federal power proponents have cooked up to harass the power companies reincarnates the old proposal for a giant power grid. Now, this is a cunning device, outwardly so simple that socialist-minded politicians can rally their public power plans around it and the uninformed public just might find it attractive.

In reviving the giant grid proposal, the politicians say glibly that all we need is a massive national network of transmission tie lines interconnecting giant, efficient (and federal) generating plants, and cheap power will be available for all. They will imply strongly that by not combining forces to provide such interconnections, the private utilities have missed sterling opportunities for economies, with the result that consumers pay higher power prices and power shortages impend.

They propose an investigating committee "to determine the facts." But the facts are the last thing the investigators will want. They will prefer to ignore factors like carrying charges on transmission investment which offset much of the economic gain of an interconnection, and the basic tendency of new capacity to locate adjacent to load centers.

Any planning engineer could explain the basic economic factors of interconnections to the committee, but since the investigators' prime objective is making government power available to everyone they may not pay much attention to such information.

The challenge has been laid down. The utilities will have to spend much effort in preparing and presenting testimony (always assuming they are allowed to testify!) in defense of what they've already done in this field. They must assemble their facts at once—facts which clarify the difference between their 12-15% carrying charges and the 5-7% on government and co-op lines—facts detailing the economic limits to which systems can interconnect. And they must show, by illustration and catalog, past due diligence in studying and making interconnections.

Above all, though, their case must be stated simply, broadly and in terms unmistakable to politician, press and citizen. The detailed facts must be at fingertip for ready backup; but the prime presentation must be simplicity itself.

This calls for consummate skill. But the stakes are so high this skill must be found and used. The giant power grid proposal will not be easily disposed of this time.

Bringing Creative Approaches to Tower Design

Today as the trend to higher transmission voltage accelerates, economy in tower design is having an increasing impact on the economics of transmission.

But on the other hand the very need for higher capacity transmission that is sparking the drive to higher voltages is bringing to the fore new mechanical and structural problems that relate directly to conductor life and tower adequacy.

In the face of these apparently conflicting needs, it is encouraging to find a growing wave of interest in new structure patterns that combine ingenuity with strength and economy through studied application of unconventional concepts and materials.

Rate Hike Bids Hit Some Roadblocks

Oregon suspension is hurting rates of return for two utilities, Union Electric hit by another delay, Houston Lighting still enmeshed in a demand meter wrangle

When Howard Morgan left his post as Oregon Public Utilities Commissioner, one of his last official acts was to suspend rate increases filed by Portland General Electric Co and Pacific Power & Light Co.

Morgan, a Democrat who had aimed his guns at power companies several times during his two-year tenure, has put PGE and PP&L behind a roadblock that threatens to crimp their rates of return.

PP&L, for example, estimates its earnings below 5% on fair value under present rates. If proposed rates were in effect for all of 1959, its rate of return still would be "well under 6%," PP&L said in filing for the new rate Dec. 22.

And PGE said that without the increase its '59 return "clearly would be inadequate to keep pace with the growth in our area."

Delays Affect Other Utilities

Their dilemma is shared, for varying reasons, by about half of the utility companies with rate increase applications now pending. The delays help explain the growing interest in proposed provisions for granting quick rate action subject to later review and, if necessary, refunds (EW, Nov. 3, 1958, p 45).

PGE and PP&L now await scheduling of a public hearing by the PUC. Pending the hearing and the decision of the new commissioner, Jonel Hill, the proposed tariffs are stalled until July.

The outgoing Morgan questioned whether the company was not calling on its customers in non-competitive areas "to subsidize the competitive struggle of the company in areas where public power does exist."

PP&L's proposed hike wouldn't apply in six service areas next to public power systems. The company's letter of transmittal to Morgan pointed out, "any deficiency in the company's earnings in these areas will be borne by its stockholders." Competitive rates in such areas are permitted by a 1949 order of the PUC.

Morgan also attacked the 14.5% hike sought in Oregon vs a 10% average for areas in Washington. D. R. McClung, PP&L president, quickly pointed out that the variance reflects differences in earnings on properties used for service in each state.

"We expected our rate application to be suspended for hearings as a normal regulatory procedure, but we don't think it is in order for Mr. Morgan to criticize the company's proposal before the facts of the case have been heard," said McClung.

PP&L's schedule would produce about $4 million of additional revenue. PGE's proposal, which averages 13.4%, would realize $5,190,000 a year.

A snag in its headquarters city has slowed Columbus & Southern Ohio Electric Co's bid for a $3.4-million increase.

The company filed Nov. 26, 1958 with the Ohio PUC for an increase on residential and other secondary voltage service in Columbus and unincorporated areas of Franklin County. Before the application could be heard, however, the city passed an ordinance Feb. 16 to extend existing rates for another year. The company appealed this ordinance to the PUC. Hearings on both actions are due in April.

Union Electric Case Set Back

Union Electric Co's proposed $6,236,000 increase received a second setback by the Missouri Public Service Commission. UE first filed last September and the rates were to have gone into effect Oct. 16. The PSC ordered a 120-day suspension and scheduled a March 2 hearing. Before the hearing, the agency moved the effective rate date back to Aug. 12, 1959.

Otter Tail Power Co has put through an average 7% increase in 177 Minnesota communities and expects success in negotiations with some 50 South Dakota towns for an average 6% hike. Neither state has a commission.

A 6% average increase was filed in North Dakota a year ago. The request, representing a revenue increase of about $450,000, was turned down, however, in September. Otter Tail appealed and expects a ruling within two months or so. One observer opined that the decision already has cost the company money in higher interest rates imposed when Otter Tail floated a $9-million bond issue last August.

Iowa-Illinois Seeks Judgment

The city council of Iowa City has not responded yet to Iowa-Illinois Gas & Electric Co's proposal that they seek a declaratory judgment on differing views of the company's rate needs. Iowa-Illinois requested an additional $353,166 electric and $133,257 gas revenues 13 months ago. The city council authorized $82,000 and $59,000, respectively. For the company's Illinois district it sought $530,260 annually. The commission's approval of a $269,570 hike brought an Iowa-Illinois request for a rehearing on grounds that evidence on fair value and rate-of-return determination was ignored. This request was denied. On Feb. 26, the utility filed an appeal in the Rock Island circuit court.

When Consolidated Edison Co of New York, Inc, sought late in 1956 to abolish conjunctional billing, its president then, Harlan Forbes, estimated the change would add $8 million or about 2% to gross revenues and about 10% to net. One observer close to the case said he felt something would develop this spring. One bill that would have made conjunctional billing mandatory for customers who now have it died last fortnight in Albany.

A lengthy Houston, Tex., fight to outlaw demand meters has led to a legal opinion that they can't be banned without a full-scale rate hearing. An eight-hour hearing March 6 brought a request by Houston Lighting & Power Co Attorney

William A. Brown that the city council delay action until a rate-base study is completed in April.

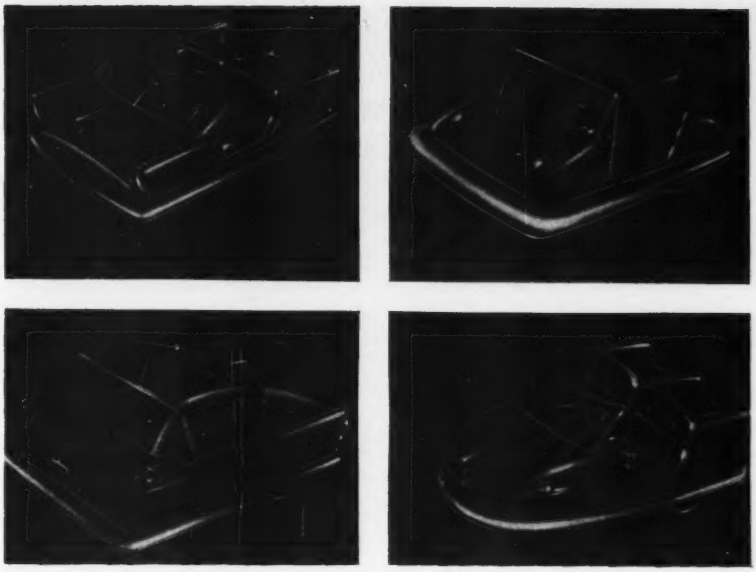
Clinton Owlsey, the city's public service director, contended HL&P would lose only .09% of its rate of return on gross investment and .1% on its net, if demand meters were eliminated. The company has 36,000 of the meters in 11-counties.

Gross Return Would Be 5.79%

Total 1958 demand meter revenue was $370,368, after taxes, Owlsey said. Removal of these meters would reduce gross investment return to 5.79%. His figures showed return on net was 6.9%.

Other rate developments include:

- Niagara Mohawk Power Corp's $10-million request must be decided, by law, before May. Its return of slightly over 5% has held about the same since the April, 1958 filing. Opposition from Buffalo industrial customers brought an "extremely thorough review."
- Cincinnati Gas & Electric Co still has had no hearing date set for its $2,228.000 request which was filed last April.
- Newport Electric Corp's two-year-old proposal for a fuel clause adjustment is near a settlement. The Rhode Island utility administrator has been engaged on a telephone case in the meantime.
- Bangor Hydro-Electric has not yet announced whether it will file exceptions to a 5.75% rate of return ordered by the Maine PUC.
- Central Maine Power Co's 7.5% request has reached the petitioners' cross-examination stage before the PUC. CMP filed for $2,794,000 increase in February, 1958.
- Public Service Co of New Hampshire has been allowed an advance of $503,000 per year, retroactive to last October. Both the state and PS have appealed to the state's Supreme Court on the retroactive element of the commission's finding.
- San Diego Gas & Electric has withdrawn a request for additional increases over $2,131,500 granted last October.
- Ohio Edison Co's $700,983 application was scheduled for review last Tuesday by the Akron city council. A public utilities committee has reported favorably on the request.
- Quincy Electric Co's $115,000 hike went into effect March 1.



Electrics like these may retail for $750 as . . .

Bolsey Aims for No. 2 Market

The designs above are for an electric car which would cost suburbanites about $750, weigh 350 lb, run 50 mi per day on one charge, and operate on $3 a month for electricity.

The designer, Dr Jacques Bolsey, says these figures are feasible if he can get the backing to finance the development needed for mass production. Dr Bolsey, probably best known in the U. S. for his Bolex home movie and Bolsey still camera equipment, maintains that the design is the first that aims strictly for the second car market.

"The success of the Rambler, even though it is still a first-car design, and of small European cars indicates the large market potential for a definite type of second car in each family," Dr Bolsey says.

His car is a 6 x 9-ft "Bolsey Shopper-Commuter," which "is basically a low platform on three or four small wheels with low-pressure tires." The car will provide maximum safety.

Only three to five conventional auto batteries would be needed to power the Bolsey electric's two rear-wheel motors. "Three to five horsepower will be sufficient" for the vehicle's 40-mph speed, Dr Bolsey believes. On downhill grades, the motors will automatically recharge the batteries while also providing a "compression-like" effect. In addition to conventional foot-pedal braking, the floor-board accelerator acts as a brake when depressed quickly.

Dr Bolsey, a physicist and designer who came to the U. S. from Switzerland in 1939, is enthusiastic about the safety features and wheel innovations for which he has filed patent applications.

Unique Safety Features Planned

The reinforced plastic body, for instance, will have high impact resistance, "something like a football helmet." A "surrounding shock absorber" around the bottom of the body will provide resiliency. And the front portion of this shock absorber extends 2 ft, "so if you hit a tree, it's like having a big rubber ball there to cushion the impact." The car's low center of gravity "makes it practically impossible for the car to turn over."

When asked for his next step, Dr Bolsey replies: "To interest others—financiers, the public, utilities." As for the future of the electric, "We definitely will see the day when they'll have a range of 300 to 500 miles as improvements come in the batteries—the one missing link in our realization of the incredible potential of electric energy."

GEORGIA SENATE is scene of exchange between C. M. Wallace, Jr, right, at podium, Georgia Power vp, and Sen Robert Culpepper, author-sponsor of bill

Co-op City Sales Blocked

At recent electric cooperative meetings a recurring battle cry has been to "maintain territorial integrity." In other words, continue serving an area even though the farms that the co-ops were formed to serve many no longer even exist there. This concept, and arguments against it, came before the Georgia legislature last month. The issue is one coming to the fore in other U. S. areas in the near future. Here's what happened:

An REA-backed bill to allow co-ops to serve within city and town boundaries was rammed through the Georgia Senate after a hot fight.

When first introduced, the bill proposed amending a 1937 REA Act to allow co-ops to serve areas newly annexed by cities and towns. An amendment, which was added before final Senate action, limited the co-ops to an area "not exceeding 1,000 ft from any existing primary lines" a co-op "at the time of annexation or inclusion of any portion of rural area . . . within limits of an incorporated or unincorporated city."

Co-ops Offer 3% of Gross

One manager among the battery of co-op spokesmen appearing at a pre-vote hearing surprised the opposition by saying, "The co-ops are ready and willing to negotiate on paying 3% of gross to the cities in which they operate." The 3% is an ad valorem now paid by Georgia Power to cities in which it serves.

The municipal association's executive secretary, Elmer George, cited a 1937 state law permitting co-ops to serve only rural areas. "You can't make rural mean urban by any amount of redefining," said George. "That is fraud pure and simple. The cities and towns of Georgia are faced with REA's arrogant attempt to take over the electrical business on a nationwide basis."

Spokesmen for the municipalities dwelt on the tax-free co-ops and their 2% interest rates, while claiming cities and towns desperately need the utility tax money from newly annexed areas.

Georgia Power's C. M. Wallace, Jr., argued: "We say these co-ops should stay in rural areas. Whenever they find themselves within the boundaries of a municipality, they should sell out to the municipality or such regulated public utility as furnishes service there."

The state's 50 towns and cities buy from Georgia Power or from federal projects. Georgia Power generates about 75% of the kwhr distributed by these municipal systems, and the company wheels all the federally generated power.

After Senate passage, the bill was delivered to the House Industrial Committee. It was then assigned to a subcommittee where it was shelved. Says Rep Taylor Phillips, head of the move to shelve the measure, the bill should have two amendments before being up for a vote: **1.** REA co-ops should be put under the Georgia Public Service Commission. **2.** They should be subject to the same taxes as other community services.

Neither the bill's proponents nor its adversaries are willing to speculate about its chances next year.

EEI Annual Meeting to Explore Future Challenge

"Electric Power for a Strong America" is the theme for Edison Electric Institute's 27th annual convention. Speakers will concentrate on challenges facing investor-owned utilities during the April 6-8 New Orleans session.

Among key speakers will be leaders of the industry, top government officials, and others close to electric utility fields. EEI President J. E. Corette, for instance, will explore basic "gaps" between U.S.S.R. and U. S. systems; Mark Cresap, Westinghouse head, will chart the industry's new dimensions; Sen Barry Goldwater (R-Ariz.) will call for preservation of our freedoms; and John McCone, AEC chairman, will answer nuclear power questions.

Women's importance to utilities is the topic of Mary G. Roebling, Trenton Trust Co president. C. M. Wallace, Georgia Power vp, will discuss "climate control"; future system design is scheduled for Lewis R. Gaty, Philadelphia Electric Co vp; assets of informed customers will be discussed by J. K. Busby, head of Pennsylvania Power & Light Co; and ways to meet the industry's challenges will be described by J. B. Thomas, chief of Texas Electric Service Co.

First Strike Talks Held By Allis-Chalmers, UAW

The first negotiating sessions began March 7 between Allis-Chalmers Mfg Co and the United Auto Workers to end a strike which closed eight plants February 2. Four of the closed plants produce electric utility equipment. The company said it lacked detailed information on shipments from these plants as EW went to press.

The initial get-together was limited to negotiating the procedures which included plans for local bargaining at the shut-down plants. Prior to the meeting, the eight A-C works filed charges with the National Labor Relations Board accusing the UAW locals of refusing to bargain. The union has held out for a "master-uniform" contract instead of local negotiations.

U.S. Power Picture

Tennessee Town Plans System to Duplicate KU's

Negotiations have collapsed between Weakley County Municipal Electric System and Kentucky Utilities Co over purchase of KU's distribution system in South Fulton, Tenn. As a result, the municipal system "will now proceed with plans to erect its own distribution system . . . either parallel or under the existing lines" of KU, said Brooks Crockett, WCMES superintendent.

The power company offered to sell its facilities in the town for $173,374. Appraisals by WCMES, based on a valuation of 56% of original worth, brought an offer of $125,222, according to Crockett.

He maintained that an equivalent system could be built for $166,040.

KU will continue to furnish power to South Fulton, however, said R. M. Watt, KU board chairman.

"We can't walk off and leave people without service," he said. "We just have to take what's coming. In Tennessee, the property owner seems to have no protection, particularly the utility property owner."

Watt's reference was to a Tennessee law which allows duplication of power facilities. Kentucky, on the other hand, forbids it.

The Kentucky law has stalled efforts of Paducah, Fulton, Princeton and Glasgow to acquire TVA power. KU has said it is not interested in selling its holdings in these cities.

Lengthy Paducah Battle Seen

In Paducah, Mayor George Jacobs predicted the city probably will get involved in a long court battle in its efforts to buy KU facilities there. He made the prediction after the city board of commissioners voted 5-0 against renewing KU's franchise. The city hopes to operate the distribution system with TVA power after KU's franchise expires in 1960.

"TVA hasn't said it would refuse us power, but it hasn't said it would furnish us with power either," said the mayor.

Paducah's legal representative is Joseph Swidler, former general counsel for TVA, who now has his own law firm in Tennessee.

BYPASS would answer High Mountain Sheep Dam criticism from fish interests

Fish Canal Proposed for Snake Dam

A 17-mi by-pass canal would be Pacific Northwest Power Co's answer to criticism that its proposed 670-ft High Mountain Sheep Dam would block the Imnaha River to migratory salmon and steelhead. Plans for the canal, which would carry fish in both directions, were revealed Feb. 27 to the Oregon Water Resources Board. The board had been asked to block the middle stretch of the Snake River from further hydroelectric development, but has deferred action.

The Corps of Engineers' recent "308" report designated High Mountain Sheep in this stretch as the key project for comprehensive development of the Columbia Basin.

Pacific Northwest Power, owned by Portland General Electric, Pacific Power & Light, Montana Power and Washington Water Power companies, has applied for a license to construct a concrete-arch type structure impounding a lake, reaching 58 mi up the Snake, of 2.7-million useable acre-ft storage. Capacity would be 1,520 Mw.

High Mountain Sheep purposely was located a mile above the confluence of the Salmon with the Snake, thereby preventing interference with the Salmon's 28% contribution to all anadromous fish above McNary Dam on the Columbia. The Imnaha, which without the canal would be blocked by the new dam, contributes less than 3%, but even this amount is considered significant by fish interests.

The Imnaha's fish population will be protected by teaming the by-pass canal with conventional tramway-type elevating devices to transport them around the dam. A fish screen handling the entire Imnaha will assure that all downstream-bent fingerlings are diverted to the canal rather than reach the dam's forebay. The canal will follow the natural contour of the Imnaha canyon, providing resting pools and gravel riffles along the way. At the dam, the conventional tramway will take over to lower the fish to the dam afterbay. The canal discharge water will provide an attraction current to lure upstreaming adult salmon to the lifting facilities. Salmon headed to and from the upper Snake will use separate facilities.

Mountain Sheep 'Best Way'

PNP is urging early construction of High Mountain Sheep as the "best way of protecting the most valued spawning grounds of the entire Columbia Basin." Its spokesmen have termed the proposal to defer construction on the middle Snake "invitation for the eventual construction of Nez Perce and its inherent peril to the fishing resources of the Salmon."

Nez Perce, which would block the Salmon River as well as the Imnaha, is the choice of public power groups.

The Washington Wire

Whitmore Asks for Law on Co-op 'Raids'

The controversial $120,000 loan to Central Iowa Power Cooperative (CIPCO) to serve an industrial firm exploded again ten days ago—this time before a Senate Agriculture subcommittee.

Charles H. Whitmore, Iowa-Illinois Gas & Electric Co president, told the subcommittee that the co-op had "raided" his company's area "to capture" the Lehigh Sewer Pipe & Tile Co service, and "the raid was financed by an REA loan which we believed was illegal. We tried to protect ourselves, but the raid was successful."

Whitmore asked the subcommittee to enact legislation which would give legal standing in court to persons "aggrieved by REA loans." There is presently no way to get a court test on the legality of such loans, he said. Whitmore pointed out that Iowa-Illinois had brought suit in the District of Columbia's federal district court "for a declaration of rights and an injunction against the (CIPCO) loan. Our complaint was dismissed without any decision on the merits, and on the ground that an earlier case required the holding that we did not have standing to litigate the validity of an REA loan." Subsequent appeals to the U. S. circuit court and the U. S. Supreme Court also were denied.

Aiken Resolution Debated

For a while, subcommittee members appeared concerned over Whitmore's request. However, witnesses for the National Rural Electric Cooperative Assn turned their attention back to the purpose for which the hearing had been called—to consider a resolution (S. Res. 21) by Sen George Aiken (R-Vt.) and 13 other senators that such loans, as made in the CIPCO case, are permissable.

The resolution was introduced to repeal possible action by the General Accounting Office against the loan. Last August, Comptroller General Joseph Campbell ruled that the REA loan to the co-op was illegal because it was made to provide service to a customer (Lehigh) already being served. Campbell added that the REA Act was not intended to provide service to unserved rural customers "within a reasonable distance" of existing power lines (EW, Aug., 11, p 35).

Campbell later softened his ruling, then finally shelved it "in the absence of an expression of Congressional intent to the contrary."

However, said NRECA General Manager Clyde Ellis, although Campbell "narrowed the extent" of his ruling, "he did not change his basic position." It is "ominously" clear, Ellis said, "the REA program will be permanently damaged" unless the ruling is withdrawn or changed.

Nub of the controversy involves the old question of Congress' intent when it passed the REA Act:

- Whitmore contends the act was never intended to finance duplicate facilities, or to serve rural customers already linked to central stations. He charged specifically that Lehigh was getting power from his company when the co-op built its REA-financed 20-mi line to the pipe plant.

"To approve the resolution (S. Res. 21) would be for the Senate to say that it was, and is its intent to have REA make loans of federal money for the purpose of taking customers away from private utility customers and handing them over to cooperatives," he said.

- REA Administrator David Hamil and NRECA spokesmen claim the act was intended to provide service to all unserved rural customers, regardless of their proximity to available power sources. And they also claim the CIPCO loan was made to a "new" plant of Lehigh, 160 ft from the old one served by Iowa-Illinois.

Both of the plants are now served by CIPCO through a single meter.

Missouri River Allocations Aired Again

The Senate Interior Committee held a second hearing March 5 to let Assistant Interior Secretary Fred Aandahl answer complaints that federal mainstem Missouri River hydro plants would not furnish enough power to preference customers in 1963.

Aandahl admitted that the U. S. Bureau of Reclamation's Missouri River facilities could supply only about 54% of preference customer requirements (1,850 Mw) in the Missouri Basin's Eastern Division through 1963. But he pointed out these customers have their own generating facilities totaling 1,476 Mw.

Charles Robinson, a staff engineer for the National Rural Electric Cooperative Assn, testified, however, "As long as there exists the prospect and promise of additional low-cost Missouri River hydroelectric power on the horizon, investment in steam electric stations, which may stand idle much of the time, cannot be risked" by co-ops. He called for more federal hydro plants, plus federal steam plants to back them up.

Robinson blamed the "failure" of basin projects to "meet anticipated schedules" on sub-normal streamflows in recent years; "no new starts" policies by the Budget Bureau; and the "general conservative power marketing policies" of Interior.

Sen. Carl Curtis (R-Neb.) hit the method of allocating federal power on the basis of customer's own generating facilities. Nebraska is being "penalized," he said for having built its own public power facilities.

Colin Raff, vice president, Montana Power Co, called federal power marketing laws discriminatory. "The people of Montana . . . are deprived of the opportunity to share in the power which is produced in Montana," he said.

Raff criticized the bureau's plan to cancel the sale of 25 Mw of firm power to Montana Power after April 30, 1962 for distribution to 13,000 direct customers, two co-ops and Glasgow Air Force Base.

EEI T&D Men Debate Utilization Voltages

Chicago meeting discusses storm damage, epoxy resins, cable drop standardization, street lighting lamp fixtures

Higher secondary and utilization voltages, storm damage prevention, residential underground distribution, and the reduction of cable joint and terminal costs through using epoxy resins were discussed by the Transmission & Distribution Committee of the Edison Electric Institute in Chicago Feb. 12-13. The next meeting will be at the Shoreham Hotel, Washington, D. C., May 6-8.

Recognition of higher secondary and utilization voltages in the standards was recommended in a draft of a report by EEI members of the EEI-NEMA joint committee. NEMA members did not concur in the report recommending that 240/416 v be recognized as the preferred voltage and 240/480 and 265/460 v as alternatives.

Power company representatives urged recognition of the higher voltages and were supported by R. F. Lawrence, Westinghouse Corp. H. Watson, General Electric Co, argued that the change would make it more difficult to compete with the gas industry. Harold Campbell, GE, questioned whether industrial plants would use 240/416 v, even in new plants. Robert Day, GE, cited problems of larger appliance stocks in the transition period. Recommendations will be studied further.

Three companies reported on measures for strengthening systems and reducing damage by storms. J. F. Hennessy spoke for Baltimore Gas & Electric Co, H. McVaugh for Philadelphia Electric Co, and J. Ewald for Public Service Electric & Gas Co. Measures taken by these companies included:

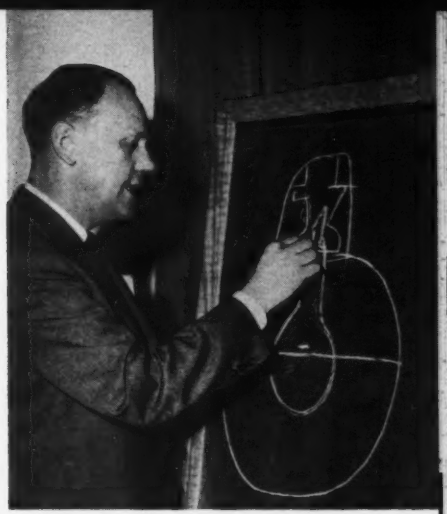
1. Installation of heavier poles, particularly at junction points.
2. Installation of aerial and spacer cable.
3. Reinforcement of crossarms.
4. Installation of heavier guying and larger anchor plates.
5. Increasing the size of conductors and replacing smaller conductors in service on a regular basis.
6. Design for 1 in. of ice at inaccessible places.
7. Doing more line sectionalizing with both fuses and reclosers.
8. Changing from series to multiple street lighting.
9. Studying and taking steps to improve service restoration procedures.
10. Changing to steel pins in crossarms.

G. W. Grueneberg, Consumers Power Co, described an underground distribution system for a high-class residential subdivision. Primary cables are in ducts encased in concrete. Secondary cables are protected by a layer of sand and 4-in. concrete slab on the sand. Transformers are in vaults, whose tops extend only slightly above grade. Cost of the system, said Grueneberg, was about 4½ times that of an overhead system.

Works with Builders

D. R. Jenkins, Commonwealth Edison Co, told how his company works with builders to provide underground distribution to subdivisions where a minimum of 24 homes will be built on adjacent lots at an early date. These conditions permit mass-production techniques in installing distribution facilities. Cables are direct-buried. The builder trenches and backfills for cables, excavates and backfills for the transformer vaults, and installs customer services.

Builders install 100-amp services, a 240-v range outlet, and an additional 240-v appliance circuit. They pay an additional $50 per residence toward the cost of the underground installation. This cost however is scaled down in proportion to the number of major appliances or electric heating units installed. The concessions on underground distribution are offered as an inducement for the installation of adequate wiring, major appliances, and electric heating.



CENTER the light source in the street light fixture, W. H. Edman told the EEI

In 1958 projects involving underground distribution for 2,005 homes were signed, and at the end of 1958, projects involving 2,773 homes were under negotiation. Jenkins said that his company expects to sign a good portion of these, and some more in 1959.

Application of epoxy resins for making cable joints and terminations was discussed by T. C. Duncan, Consolidated Edison Co, T. E. Starrs, Public Service Electric & Gas Co, and J. F. Hennessy, Baltimore Gas & Electric Co. Extensive research was reported. All agreed that epoxies have good possibilities for improving joints and terminals at lower costs, that they are satisfactory for 4-kv service but that substantial improvements will have to be made before they are satisfactory for higher voltages.

Fault locating in pipe-type cable resolves into two types, approximate and exact, said E. J. Steeve, Commonwealth Edison Co. Of the approximate methods, the Murray loop has been used chiefly by Commonwealth. The reflected impulse or radar method, the electric pulse timing method, and the resonant line method, however, have been used also. For pinpointing the fault, the sound-distance, sound-level, sound-directional and tracer-current methods have been used. Steeve said that sometimes several methods are used.

Detroit Edison Co has trained

(*Continued on page* 66)

Cooperation with Coal Industry

Large quantities of coal remain in the ground, but there is a difference between having it there and having it ready for the furnace. Coordination between electric utility and coal supplier can make this fuel available at minimum cost.

While reserves remained ample, coals obtainable at least mining costs were claimed first. But it is becoming necessary now to go deeper, which boosts mining costs. Coal near the surface is nearly stripped out, and coal remaining for strip mining has a thicker dirt cover.

One large supplier estimates that 75% of coal reserves will have to be taken by underground mining. Strip mining, nevertheless, continues in use wherever ground cover is 100 ft or shallower. At 100 ft or deeper, it is necessary to go to punch mining, an auger boring for the coal.

Mining Investment Much Heavier

Economical mining today demands a much heavier investment in mechanization than in the past. For example, in one of the latest strip mining operations, earth cover is removed by an electric shovel that picks up 105 tons at a bite. One man operates it from a third-floor operating cab. The shovel, more than 100 ft high, fills its dipper at a bank as high as a 12-story building. It could dump its load on top of a 10-story building.

Underground mines are more mechanized too. The trend is to continuous mechanical miners with belts attached. In one mine several belts in sequence—amounting to a total of 4 miles of belting—haul coal all the way to the surface. These techniques eliminate shuttle cars.

New belts and belting make new methods practical. Steel rope belts with idlers suspended between two steel cables have increased the length of belts and reduced their number for a given hauling distance. These mechanized methods have increased production, one large mine producing as much as 24 tons per miner per day. Average output is 16 tons per unit per day.

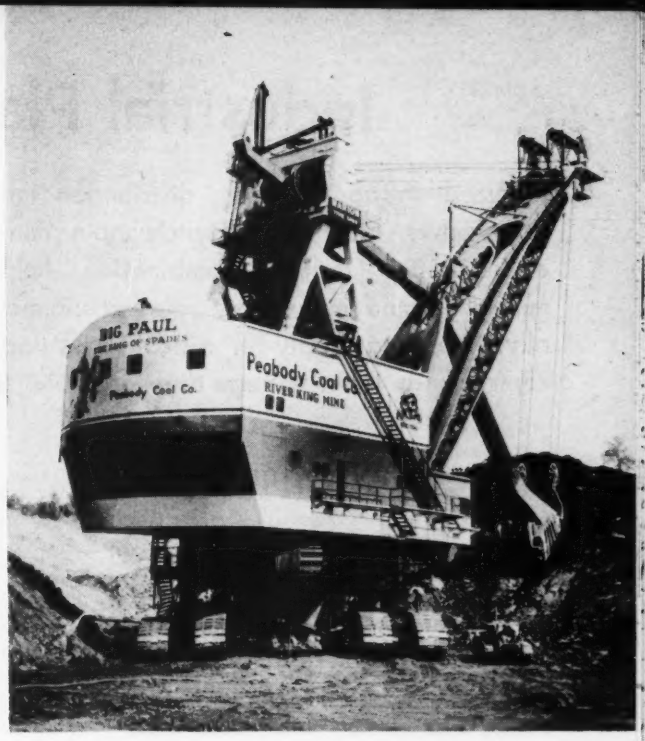
Coal suppliers report that the cost of opening new mines has increased year by year. Mechanization and the need for going deeper are among the reasons. These increase the gamble of operators and make long-term contractual arrangements more important.

Through a close relationship between supplier and user some risk can be removed. There is more and more activity on such a basis. It assures one of an adequate supply of coal of a quality suited to his purposes; the other, of a market. As a rule the longer the term of the contract, the lower the cost of coal to the user. If the supplier is to relate his activities to power generation requirements, he must be told those requirements. By working closely with the user, he can obtain properties at desired locations and can schedule development to meet the user's coal needs.

User and supplier can work together in correlating coal source, power plant, and transportation, all important in minimizing the cost of coal delivered to the power plant. Such cooperation is also basis for developing a coal pipe line.

The cost of coal transportation may be cut by re-

Assured market gives supplier opportunity to cut mining, transportation costs and pass on savings to the coal user



HUGE SHOVEL takes 105 tons of dirt from strip mine at a single bite. Comparison with foreground tractor gives idea of equipment's immensity

COAL RESERVES in the U. S. underlay some 340 thousand sq miles and are estimated roughly at about 13,000 tons for every man, women and child

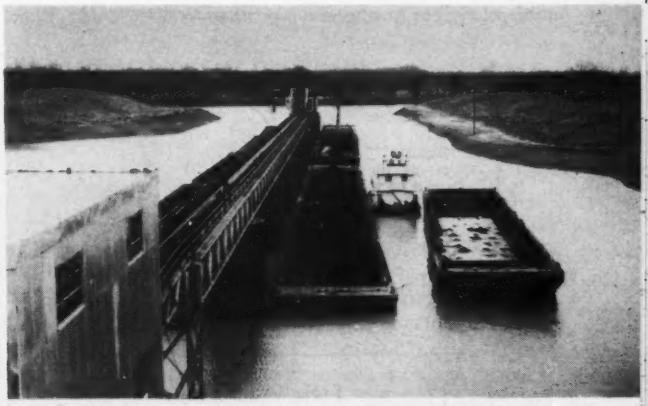
Brings Utilities Economical Fuel

sorting to mine-mouth generation. Although this practice was favored years ago, the economics of electric transmission vs coal transportation brought about the placement of generating plants near loads. But the recent construction of several mine-mouth plants appears to indicate a revaluation of all the factors.

Some utilities are reviewing this aspect of fuel supply in terms of improved long-distance electric transmission techniques, including extra-high-voltage lines. While the cost of transmitting kwhr today is about the same as in 1929, freight rates have gone up substantially. More improvements in transmission, coupled with rising freight rates, may bring utilities and suppliers together on more mine-mouth power plant operations.

The coal industry today is seeking to replace the home heating business lost to the gas and oil industries. This business was lost because of the greater convenience of these fuels. The coal industry believes it can recoup this loss by supplying more coal for the production of electricity for electric house heating. It is therefore particularly receptive to proposals of cooperation with electric utilities for long-term supplies.

MECHANIZATION has reached to washing and preparation operations. Plant loads up to 11,000 tons in one shift



COORDINATION of power plant and mine locations permits low-cost marine transportation from supplier to the user

Industrial Plant Voltage Dips Can Be

Reduced voltage starting, distribution improvements, and use of synchronous condenser-buffer reactor combination help minimize annoying voltage dips economically. Isolating supply for critical loads and controls may make voltage dips tolerable

BRUCE G. BAILEY, Application Engineer, and
A. H. KNABLE, General Engineer, Switchgear Dept, Allis-Chalmers Mfg Co, Milwaukee, Wis.

Voltage dips in industrial systems may often be alleviated by relatively minor modifications in system design and control. In some cases, a modernization program is necessary, but much relief can often be gained through less expensive methods such as: isolation of critical loads; improvements in the distribution system; reduced voltage starting; or the application of a synchronous condenser-buffer reactor combination.

The first step toward solving a voltage dip problem is to study the voltage profile of the system. Fig. 1 shows the steady state voltage drop of a representative system. When a motor is started on the same bus, it may temporarily draw 5 to 10 times full-load current and increase the drop in the branch circuit to 5 to 10 times the steady state value. Drops in other parts of the system will also be considerably increased and other equipment may be disturbed.

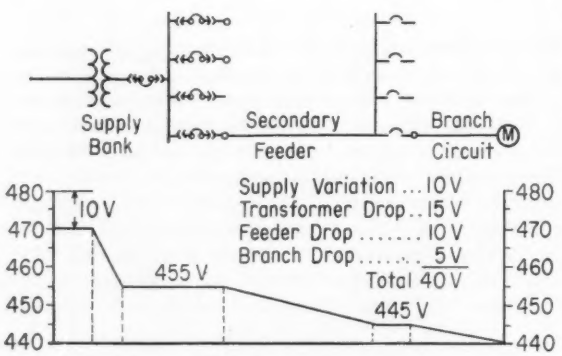


FIG 1—STUDY OF VOLTAGE PROFILE of system is first step in the solution of a voltage dip problem in an industrial plant

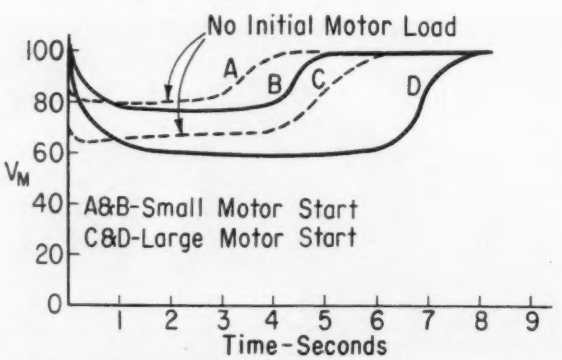


FIG 2—VOLTAGE DROP caused by motor starting is slower with other load on bus, but total dip is more severe

The most obvious remedy for voltage dips is to improve the distribution system. Circuit impedances can be reduced by installing larger cables; reducing circuit lengths; using low impedance bus duct; replacing widely spaced conductors with closely spaced or multiconductor cable; and using standard impedance transformers.

Current and impedance can best be reduced to a minimum by using load center substations, which permit optimum distribution and utilization voltages for the capacities and distances involved, and encourage the use of equipment with standard voltage ratings. Higher distribution voltages are also effective in reducing voltage dips.

Sometimes it is more economical to live with voltage dips than to try to eliminate them. Where light flicker is a major problem, lighting loads may be isolated from the disturbing equipment by using a separate lighting transformer, supplied from a primary substation where the bus is relatively stiff. Highly critical equipment or processes may be isolated from system disturbances by supplying them from independent power sources or, occasionally, from special flywheel motor-generator sets.

Drop-out Voltage Can Be Reduced

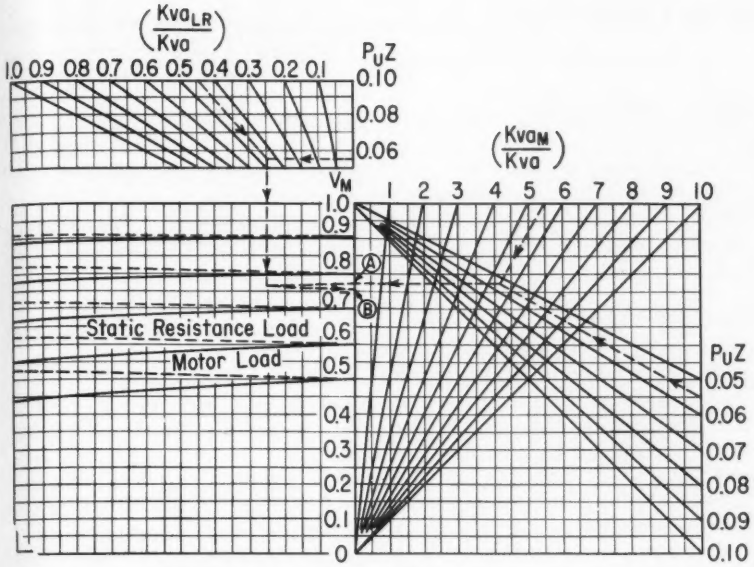
In some installations, only the control power for contactor coils and control devices has to be supplied from a separate source. A battery supply will keep them energized during system disturbances. Occasionally, latched-in contactors or time-delay drop-out a-c relays of the flux decay or charged capacitance type can be used to prevent unnecessary control operations if the equipment and system are otherwise designed to ride through short disturbances.

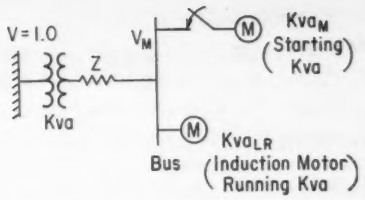
At present, there are no NEMA standards for contactor drop-out voltage. Most low voltage contactors will drop out in one or two cycles if the voltage dips below 50% of normal. Special circuits can be used to lower the drop-out voltage of air break contactors for 2.3- and 4-kv induction motors to less than 35% of normal.

Full-voltage starting of large motors often creates the greatest disturbances of all normal functions. Although most new motors will stand full-voltage starting, the resultant dips may dictate reduced voltage starting.

The dip caused by motor starting can be predicted by considering the motor starting kva, source kva, and the kva of other motors on the same bus. Fig 2 shows the voltage characteristic for a motor starting circuit consisting of a transformer supply, with and without initially connected motor load. When other motors are already running on the same bus, the initial voltage drop is slower, because the other motors feed

Be Alleviated 4 Ways





Example

1. Given:
   Kva = 1,000
   Kva_M = 5,500 (1,000 hp motor)
   Kva_{LR} = 450 (5 100-hp motors)
   Z = 5.5% on transformer Kva base
2. Find:
   V_m (Per unit voltage during starting)
3. Solution:

$$\frac{Kva_M}{Kva} = 5.5$$

$$P_uZ = 0.055$$

$$\frac{Kva_{LR}}{Kva} = 0.45$$

Applying these values to the graph,
V_m = 0.76; voltage dip = 24%

FIG 3—CHARTS PERMIT SIMPLER CALCULATION of the effect of initial motor load on motor starting dip. Results are realistic when constant torque loads are involved and source consists only of transformer. Example shows calculation

back into the bus and try to maintain the voltage. However, the total dip is more severe, because the feedback time is less than the motor starting time. When one motor is starting, all other motors are subjected to a lower voltage and draw more than normal current to maintain constant torque. This further reduces the bus voltage.

The curves in Fig 3 were developed to simplify analysis of the effect of initial motor load. They give realistic results when constant torque loads are involved and when the source comprises only a transformer. This type of supply can be assumed when the utility generators are some distance from the bus.

Voltage dip due to motor starting is often based on rated voltage at the motor terminals during starting. However, this is an approximation, since voltage drops as soon as the inrush begins, thereby slightly reducing the maximum inrush and the total dip. This error is eliminated by using the graph. The only values needed to determine the voltage dip, V_m, are: transformer or source capacity, Kva, and impedance, Z; motor starting load, Kva_M; and initial load, Kva_{LR}. A typical calculation is shown in Fig 3.

Point A is the voltage dip with no initial motor load. Point B, the dip with other motors running. In the example shown, the difference is only 2% and initial loading is thus insignificant. However, in an extreme case, this difference would increase and might mean the difference between contactors holding in or dropping out. If the initial load is resistive instead of motor, it actually decreases the voltage dip, although the improvement is too small to be beneficial.

A study to determine the minimum voltage during starting and the effect of the dip on equipment operation should indicate whether it is preferable to accept the installed cost of reduced voltage starting or tolerate the system disturbances of across-the-line starting. If the vulnerable equipment is not adjacent to the motor being started, the whole system is involved and a network analyzer study may be desirable.

When reduced voltage starting is necessary, starting torques are often the limiting factor. The most satisfactory method of starting can be determined by using the line current values for each method of reduced voltage starting, given below, to determine the starting kva and the voltage dip which will result at reduced voltage starting. With an auto-transformer starter, the line current values, in per cent of full voltage starting current, are:

80% Tap	68%
65% Tap	46%
50% Tap	30%

The 50%, 45%, and 37.5% taps on a reactor starter give corresponding values of full voltage starting current. Similarly, the 80% point on a resistor type starter reduces line current to 80% of full voltage starting current.

Arc furnaces cause rapid fluctuations in voltage during meltdown because the arc resistance is constantly changing as the charge melts. When a cave-in occurs, the electrodes may be essentially short-circuited, causing the furnace to draw 150 to 200% of rated kva.

The resulting voltage dips can be reduced by using a synchronous condenser and a buffer reactor. Although determination of the condenser and reactor ratings can be tedious, a quick first estimate can be

Example

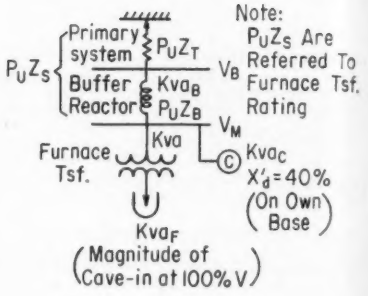
1. Given: Kva = 10,000; Kva_F = 15,000; Z_t = 10% at 20 Mva
2. Find: V_B = per unit voltage during cave-in
3. Assume: Kva_C = 6,500; Kva_B = 7,500; Z_B = 10% at 7.5 Mva
4. Solution: $\frac{Kva_F}{Kva} = 1.5$

$$P_uZ_S \text{ at 10 Mva} = (P_uZ_t + P_uZ_B) = \frac{10\text{ Mva}}{20\text{ Mva}} \times 10\% + \frac{10\text{ Mva}}{7.5\text{ Mva}} \times 10\% =$$

$$= (0.05 + 0.133) = 0.183$$

$$\frac{Kva_C}{Kva} = 0.65; \quad \frac{Kva_B}{Kva} = 0.75; \quad \frac{Z_B}{Z_S} = \frac{0.113}{0.118} = 0.76$$

Applying these values to the graph, V_B = 0.96; voltage dip = 4%



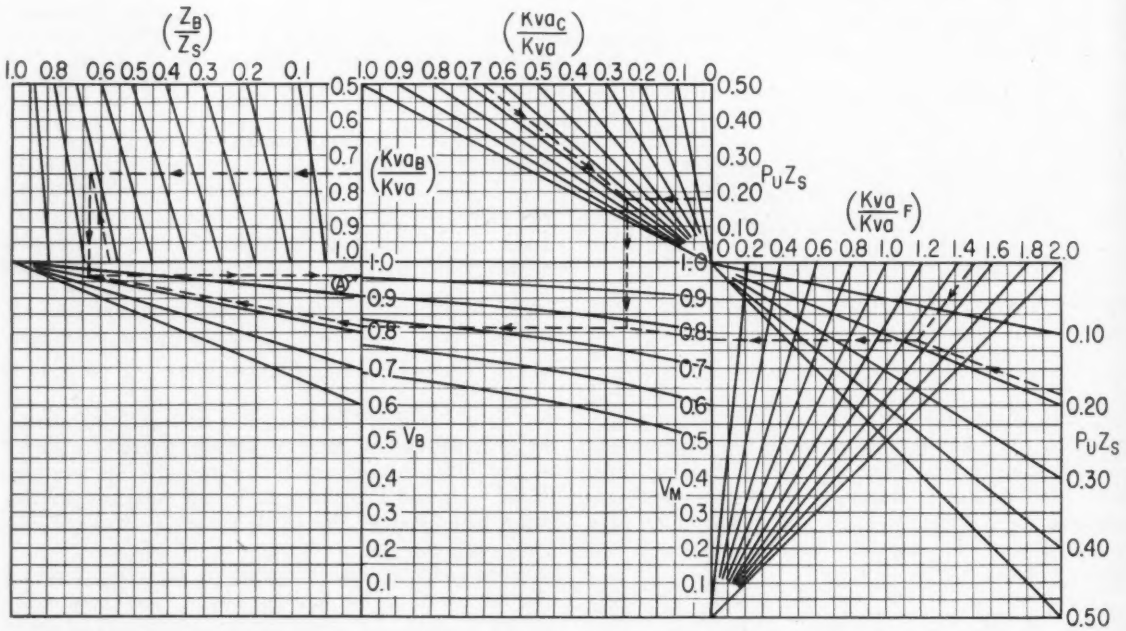


FIG 4—QUICK FIRST ESTIMATE of the ratings of buffer reactor and synchronous condenser needed to reduce arc furnace voltage dips can be obtained from charts. By varying parameters, their relative significance can be found

made from the chart in Fig 4. Results are approximate, but by varying the parameters, their relative effect and significance can be determined.

The right-hand portion of the graph determines the voltage drop on a furnace transformer due to a cave-in. The center area shows the improvement due to the synchronous condenser; the left area, the further improvement caused by the buffer reactor.

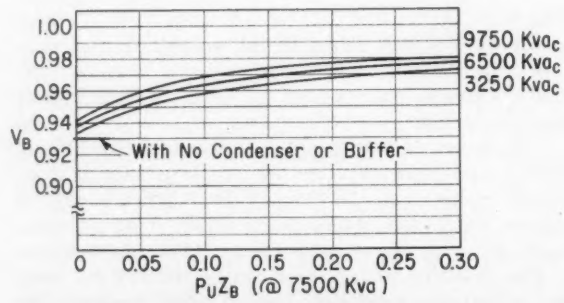


FIG 5—BEST REACTOR-CONDENSER combination is obtained by varying impedance and capacity values

Following the example shown in Fig 4, the dip with the reactor and condenser is 4%. Since the dip without the reactor and condenser is 7%, this combination reduces dip about 43%. By assuming other values for reactor impedance and condenser capacity, and following the same process, the best combination can be determined, as shown in Fig 5. Preliminary economic and stability considerations can be based on these results.

High speed breaker reclosing or high speed load transfer on the plant or utility system can also cause plant bus voltage dips which will last several cycles. Although high speed operation of breakers, in general, improves industrial operation, it may also cause a voltage disturbance on the entire bus, causing many contactors to drop out, if precautions are not taken.

Saves on Transmission Planning

Method combines aerial photography, ground control data, and profile development by stereo-plotting instruments

American Air Surveys, Pittsburgh, Pa., offers utilities a method of preparing plans and profile drawing of new transmission lines economically, swiftly, accurately. It combines aerial photography, some ground control data, and the use of stereo-plotting instruments. Steps in preparing a map are:

1. The proposed route of a transmission line is photographed from an airplane.

2. Survey parties determine the elevation and coordinates of some points identifiable in the photos.

3. Using the control points and the photography projected from glass slides, an operator plots contour lines and planimetric detail with three-dimensional mapping instruments.

4. The profile is plotted from the strip map.

The contour interval required on the finished topographic map establishes flight altitudes which can vary from 2,000 to 6,000 ft. The photo, besides being the basis for the mapping, can be used by a power company for locating stations, acquiring right-of-way, finding possible industrial sites, locating reservoirs, and calculating coal stockpile volumes.

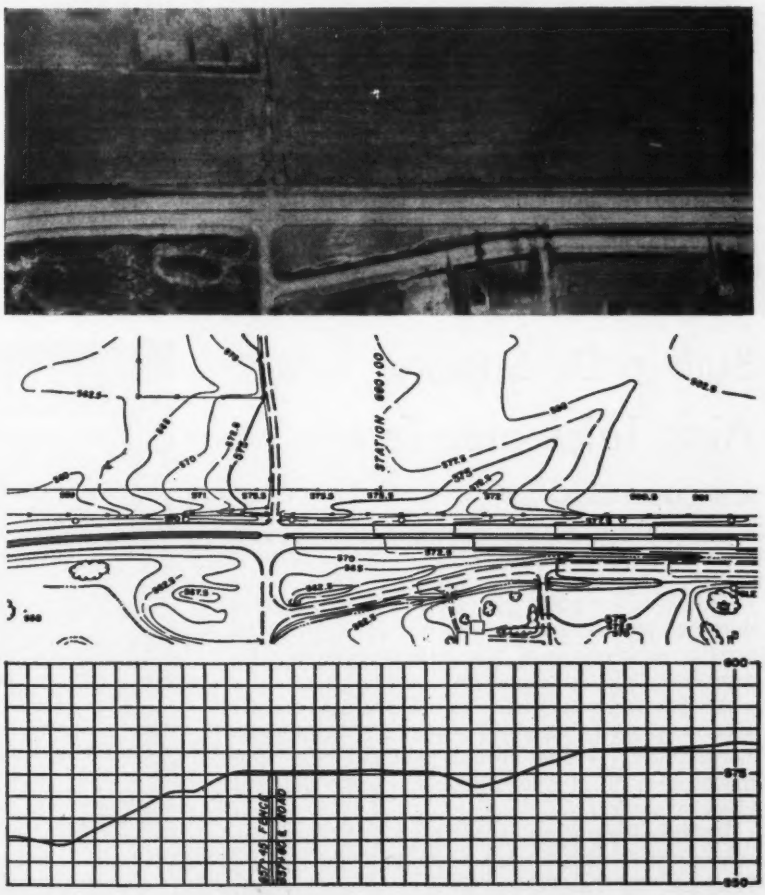
Points Are Selected

On the aerial photo, an 9 x 9-in. contact print, certain easily identifiable and accessible ground points are selected by the mapping supervisor to guide the field survey party. In areas having such points it is sometimes desirable to lay targets on the ground in advance of the aerial photographing. The survey crew obtains elevations and coordinates of these targets which are clearly visible in the prints.

Individual aerial shots, each overlapping its successor by about 55%, are printed on glass slides, and the slides are inserted in projectors. The image is reflected downward onto a mapping surface. One projector has a red filter; another a blue one. The operator, wearing glasses with one red and one blue lens, can view the projected image of the ground terrain in three dimensions. Using the survey party's control data, he levels the projected image to the exact horizontal and vertical scales.

A small part of the projected light falls on a tracing table, which can be moved freely on the mapping surface. The tracing table holds a small white platen, in the center of which is a dot of light called the "floating mark." By resting this dot on the ground's surface in the projected three-dimensional image by vertical adjustment, the operator can read on a counter the exact elevation of any point in the photo.

In plotting a contour line, the operator leaves the platen in a fixed vertical position equivalent to the desired contour elevation and moves the entire tracing table within the projected image, keeping the floating mark in contact with the surface of the ground. As he moves, a lead point directly below the dot of light traces the contour line onto the map sheet. This process is repeated with each successive contour. Such planimetric detail as roads, trees, and buildings are traced onto the map by moving the tracing table so that the floating mark follows the outline of the object in the projected image.



AERIAL PHOTO, with corresponding section of plan and profile developed from it, pertains to Central Illinois E&G's 138-kv Lincoln-Holand transmission project

Special Conduit Resists Corrosion

Because placing an 80-ton conduit unit under the Harlem River at New York City's new Broadway Bridge meant exposure to severe corrosive attack, the City specified fabrication of corrosion resistant 4-D wrought iron into the required 6 and 8-in. conduit.

The conduit was placed on a sand base in a 10-ft deep trench blasted into the river's rock bottom 33 ft below water surface. The trench was then backfilled with sand.

The 316-ft conduit unit was assembled on the deck of a 327-ft scow and then lowered by four cranes. It took less than 3 hr to lower the unit into the underwater trench. A row of five 6-in. conduits was positioned on top of five 8-in. conduits.

Special split sleeve couplings were used in preassembly of the conduit on the scow. Design of the couplings was planned to offset bending stresses encountered in lowering the entire unit.

Two ends of conduit were butted together inside the split sleeve coupling. Two clamps secured longitudinal edges of the couplings to conduit ends prior to welding. Then, clamps were removed and the welding job completed.

The 4-D wrought iron conduit used conforms to ASTM Specification A-72—possessing high mechanical strength and high resistance to corrosion, shock and fatigue.

FOUR 60-TON CRANES equipped with 60-ft booms lower an 80-ton unit of 4-D iron conduit into the Harlem River

Built-in Dc Supply Aids Telemeter Test

M. R. YARGER, Meterman "A",

W. J. MRAZ, Meter Engineer, Ohio Power Co, Canton, Ohio

Testing of impulse-type telemeter recorders is simplified by adding a self-contained dc supply to the impulse generator used. The resulting portable instrument quickly locates trouble in the meter.

An adapter is connected to the output terminals to permit plugging the impulse generator directly into the recorder. A convenience plug and line cord enable the generator to operate from any standard 120-v ac supply.

The impulse generator supplies variable time intervals to test accuracy of recorder and time scales. The cam "X" can be set to vary the time output (terminals 1 and 2) over the full range of the scale. To test, relay "C" in the telemeter recorder is removed and plug "H" from the test generator is inserted. The changes eliminate rewiring and use of an outside dc source.

Clean Meter Parts With Sound Waves

Ultrasonic or sound-wave cleaning does a thorough job on minute parts for Union Electric Co's meter department. It cleans jeweled bearings, hairsprings and complicated cog arrangements. Ultrasonic scrubbing cleans inaccessible crevices and corners and is completed in a matter of seconds, or minutes if parts are unusually dirty. Parts come out as bright and clean as they were when new.

Basically, the ultrasonic equipment consists of a generator and two transducers, which convert generator output into sound waves. Each transducer is fastened to a box-like stainless steel chamber. One chamber is filled with cleaning solution; the other with neutralizer.

Parts are placed in the cleaning solution. The generator, operating through the transducer, produces sound waves in the solution causing it to boil.

The boiling action produced by the sound waves scrubs the parts free of foreign matter such as oil, grease, dirt and loose chips. When parts have been cleaned, they are put into the neutralizing liquid to prevent corrosion from the cleaning solution.

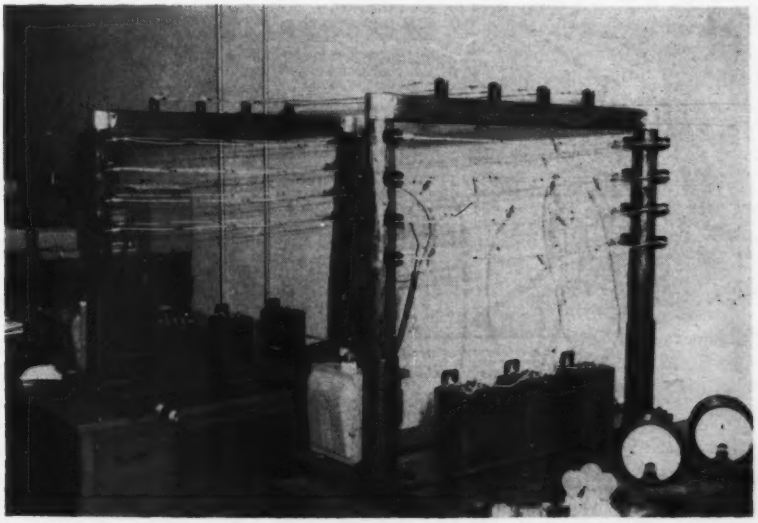
The ultrasonic cleaner is also being used on special meter jewels, entire clock mechanisms, watch parts and complete meter registers. Some equipment other than meter equipment, such as live-line jumpers, is being cleaned by the ultrasonic unit before being put into stock. The ultrasonic cleaner cleans threaded ends thoroughly.

Transformer Set-Up Aids Training

Iowa Southern Utilities Co employees are trained to connect transformers properly by instruction on two banks of small dry-type transformers. The equipment can be set up or taken down in a few minutes and is transported in a station wagon.

The seven single-phase 120/240-v transformers in the set-up may be connected to duplicate any type of 3-phase installation used on the company's system. The banks may be energized separately or in parallel.

Field connections are duplicated, and all connections are tested by instruments. Work hazards are explained and, where possible, demonstrated.



RESIDENTIAL HEAT PUMP is installed on Southern Nevada Power Co lines; 491 were put in during 1958

Why Heat Pump Is Your Best Bet

REID GARDNER, President, Southern Nevada Power Co, Las Vegas, Nevada

SUDDENLY IT'S SPRING
THROUGHOUT YOUR HOME... THROUGHOUT THE YEAR
WITH AN ALL-ELECTRIC HEAT PUMP
Spring condition your home and business with an all-electric HEAT PUMP and you will stay springtime cool all summer long.
The HEAT PUMP gives you the best in refrigerated air conditioning automatically. Operating something like your electric refrigerator, it actually pumps hot air out of your home and lets you enjoy fresh, clean, cool comfort.
And next winter—you will enjoy springtime warmth since this versatile electric servant takes care of all your heating needs too.
Be a happy HEAT PUMP owner and Live Better Electrically. You will save as much as 50% on your annual heating bill. For more information call Dudley 4-4600.
SOUTHERN NEVADA POWER COMPANY
SERVING SOUTHERN NEVADA SINCE 1909

NEWSPAPER ADS such as this helped push heat pumps. Technical details were left to dealer advertising

The heat pump is the best vehicle to increase residential and commercial usage where they are already above national average and weather conditions are favorable. This is the belief of the management of the Southern Nevada Power Co. The company has the highest reported residential usage among U. S. private utilities with 9,952 kwhr annually per residential consumer, up 579 kwhr from a year ago.

The Live Better Electrically, Medallion Home and Housepower programs have proved the best methods of selling all-electric living and heat pumps.

The heat pump emerged successful after five years' local field experience. While it still is expected that heat pump design improvements will continue at a rapid rate, company officials concluded in 1957 that heat pump sales could be promoted safely.

The decision to push heat pump sales followed a residential bill analysis, which showed 45% of our customers used only 2,640 kwhr annually while the 55% who heated electrically averaged 15,900 kwhr. The low usage customers had annual bills of $59 (2.24¢ per kwhr); the higher usage customers paid $168 (1.06¢ per kwhr).

Residential heat pumps averaged about 15,000 kwhr usage annually. This was spread over the year, with about 30% of the demand and energy in the winter when our peak occurs. Investment costs per kwhr were much lower for heat pump installations than where resistance heating was used only in winter months.

Other factors: Improved public relations from satisfied heat pump users, and increased revenues.

As a result of power company and dealer sales promotion in 1958, area heat pump sales jumped from slightly over 200 in 1957 to 746 in the first ten months of 1958, of which 491 were residential installations. Sales of heat pumps are expected to continue to increase in 1959, but at a slower rate. All heat pump sales are made directly by local dealers with our company assisting in sales promotion and technical advice.

Electrically Heated Homes Total 55%

About 55% of Las Vegas area homes are now heated by electricity. Company officials expect to maintain this ratio despite stiff natural gas competition, and to increase residential customer usage above the 10,000 kwhr annual usage mark. Practically all area homes are cooled electrically, older and less expensive homes using evaporative coolers.

These coolers are metal boxes having three sides equipped with filters of cloth-covered excelsior kept wet by dripping water. A fan draws outside air through the wet filters and the cooled air is pumped into the house. The ½-hp fan motor uses relatively little electricity. Home owners, who can afford to, use electric refrigeration for summer cooling because of superior performance over evaporative coolers. This equipment uses substantially more electricity than evaporative coolers.

The heat pump offers improved cooling service in summer over evaporative coolers, and more economical heating service in winter than electric resistance-type space heating. If the Las Vegas home owner also has electric cooking and water heating, his total bill is less than electric-gas combination for all usages.

(*Continued on page* 89)

Aluminum Transformer Shows Promise

D. F. WINTER, Vice President & Chief Engineer, Moloney Electric Co, St. Louis, Mo.

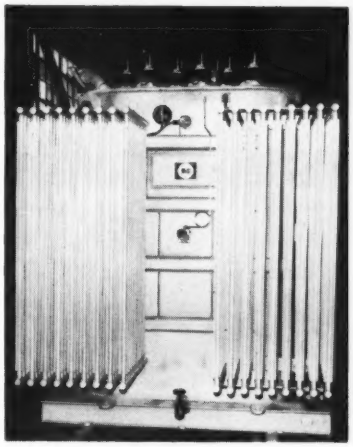
The performance of an all-aluminum power transformer, recently completed by Moloney Electric Co, indicates encouraging results in a number of areas of research interest. Objectives in building the transformer included:

1. The study of the economics and commercial feasibility of more extensive use of aluminum.

2. Utilization of the latest techniques in joining aluminum and its alloys with themselves and other metals in modern transformer construction.

3. Study of the thermal efficiency of extruded finned aluminum tubing.

The transformer constructed is a 3-phase, 3,750-kva unit with voltages of 2,400/4,160-Y to 480 v. The windings are aluminum conductors insulated with wrapped paper. The frames, tank and cooling tubes are made of various types of aluminum. The no-load tap changer utilizes aluminum conductors flash welded to copper studs



with the tap connections selected on the copper studs.

The substitution of aluminum for steel in tank and frame structures will require justification in technical performance of the product as well as by the economics. Foremost among aluminum's technical advantages is its ability to withstand severe corrosion conditions and thus reduce maintenance costs.

In recent years, the problems of joining aluminum to its alloys or to dissimilar metals have been reduced considerably by the extensive research efforts devoted to them. No difficulty was encountered in the manufacture of this unit using commercial equipment normally available to the manufacturer.

The same number of finned tubes were used as the number of non-finned steel tubes that would have been used in a conventional design. It was expected that this would produce a transformer that would run cooler than normal, but it was desired that the degree of improvement be confirmed by test.

Tests of temperature rise at various loads indicated that the transformer has a winding temperature rise of only 37C at the nominal 3,750-kva rating. The theoretical thermal capacity of the unit is expected to be 5,200 kva.

The magnitude of the increased cooling, due to the increased surface of this particular configuration of finned aluminum tubes, compared to the standard steel tubes is 175%. Readily available aluminum sections were used for the finned tubes.

Improved Tap Changer Saves Space

GORDON A. WILSON, Chief Planning Engineer, Pennsylvania Transformer Div, McGraw-Edison Co, Canonsburg, Pa.

A load tap changing mechanism has been developed which has designer-controlled switching speed and eliminates the need for shock absorbing means. The unit is of the direct-drive type. Step-by-step switching is accomplished by using scroll cam operated index plates, one plate being locked in position during the indexing of the other. The design of the index section of the scroll cam provides optimum switching speed. Thus, the arc is interrupted efficiently with minimum contact erosion and oil deterioration, saving on oil maintenance and contact life.

The switch has fewer parts and is considerably smaller and lighter than previous designs. The size was reduced by mounting stationary contacts on insulated projections away from the insulating barrier between switch and transformer. This transfers the dielectric stress from the barrier to the oil.

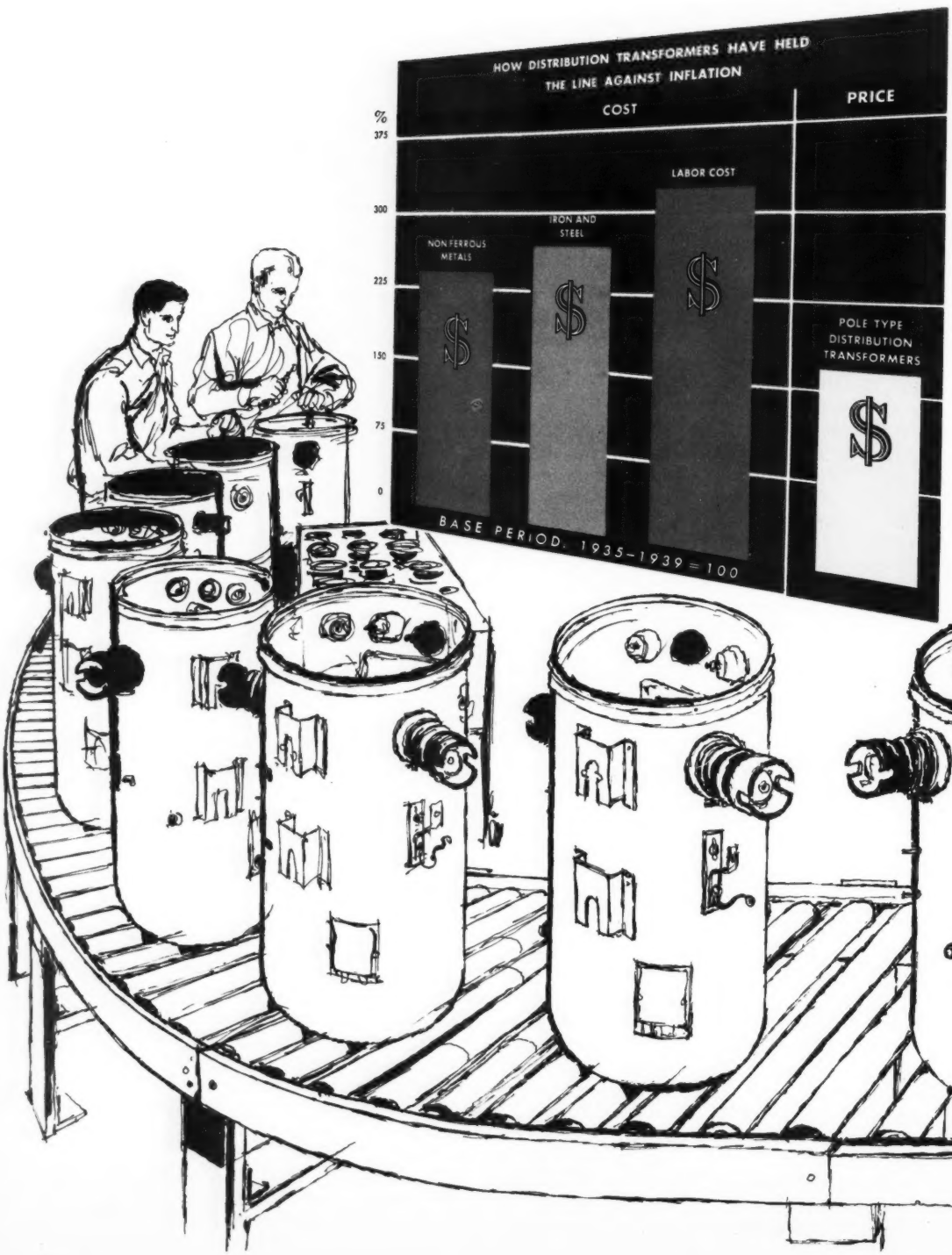
The size reduction lessened the quantity of oil needed, resulting in a lighter unit. Fewer parts and the use of sub-assemblies has lowered both production costs and the user's maintenance costs.

Three basic parts comprise the operating mechanism—arcing tap switch, drive, and control. The switch is mounted on an insulating panel, which also serves as the oil-tight barrier between the switch compartment and transformer tank. The air-filled drive and control compartment is located directly below the switch and contains the drive and control components. The sealed switch compartment is protected by a positive pressure bleeder device, which vents off pressure due to arcing when it exceeds 4 lb per sq in.

Electrical seal-in circuits are employed so that a tap change, once started, will be completed. Critical limit switch adjustment has been eliminated with the seal-in control employed. At the completion of each tap change, the capacitor-run motor is stopped by applying dc supplied by an auxiliary transformer-rectifier.

The unit is suitable for application to all 10,000-kva and smaller power transformers and to 1,000-kva and smaller power regulators.

Before you buy another



eransformer...

ANALYZE PRICE

General Electric keeps price down with standardization, volume, product innovation

Using the period from 1935 to 1939 as the base, nonferrous metals are up 135%, iron and steel up 174%, and labor is up 234%. Yet G-E pole-type distribution transformers are now up only 66%.

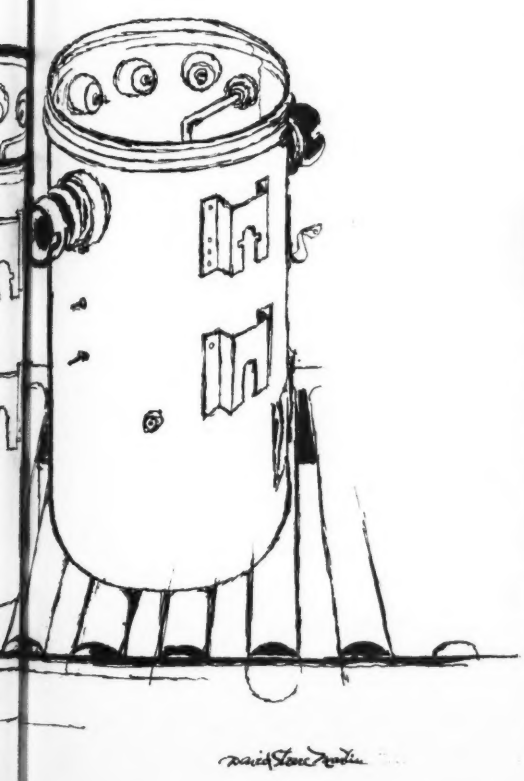
The cost of transformers remains comparatively low thanks in part to your increasing number of large-volume orders and to your support of standardization programs. Both contribute importantly to economical mass production.

Product innovations have also helped keep transformer prices down. General Electric's $1,000,000 development of grain-oriented strip steel, for example, has resulted in an estimated saving of over $300,000,000 to utilities since the steel was introduced twenty years ago.

Before you buy another distribution transformer, analyze price—give your transformer manufacturer credit for the extra values he gives you. General Electric Company, Schenectady 5, New York. 431-82

Progress Is Our Most Important Product

GENERAL ELECTRIC



GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU

		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

EEI T&D Men Debate Utilization Voltages (*Continued from page* 53)

seven engineers in the use of digital computers for solving engineering problems, said L. W. Coombe. In general, he said, less than one month in programming courses familiarizes the engineer with a particular computer, so that he can write acceptable programs in the machine language. Computers are used, said Coombe, for distribution circuit analysis, load flow, transient stability, and short-circuit studies.

R. M. Grogan, Long Island Lighting, chairman of the subcommittee on Standardization of Service Drop Cable, said that the industry has 32 different No. 4 aluminum service drop cable combinations, and that 15 different coil and reel combinations are specified. He recommended that a joint task force be appointed from the Transmission & Distribution Committee, the Meter & Service Committee, the Stores Committee, and service drop manufacturers to standardize cables, coils, and reels.

D. F. Tulloch, said that Boston Edison Co, protects uncompleted cable joints against moisture by seamless polyethylene sleeves over the joints or cable ends after silica jel packets have been inserted in the sleeve. The technique permits deferring splicing operations.

Position of the lamp in the fixture for street lighting should be given more attention, said W. H. Edman, Hollophane Co. Deviation of the center of the light affect efficiency, uniformity of distribution, glare, permissible spacing, and mounting height ratio, he said.

Cites Steam Plant Gains For APPA

The combined gas-turbine steam-turbine cycle offers the most flexible, lowest initial cost, highest efficiency, and lowest maintenance cost of any combination of prime movers today, W. D. Sinclair, Crisp County Power Commission, Cordele, Ga., told the third annual Engineering and Operations Workshop of the American Public Power Association. The group met in Springfield, Ill., Feb 18-20.

Describing the new combined-cycle plant recently completed by the commission, he said that it has a capacity of 17,500 kw with a 12,500-kw steam-turbine generator and a 5,000-kw gas-turbine generator. The gas turbine discharges a third of its exhaust gases into the furnace of the steam boiler and two-thirds through a large economizer.

Boiler efficiency on pulverized coal firing is 87.3% and on the combined cycle is 93.7%. The increased efficiency is due to heat recovery from the gas turbine exhaust gases. This arrangement eliminates a forced draft fan. Boiler capacity is 130,000 lb per hr, at 625 psi and 800F. The steam turbine is a 10/12.5-Mw unit, operating at 625 psi, 825F, and 3,600 rpm.

The plant is the outdoor type, and its cost, excluding land, was $2,303,677, or $131.64 per kw. It was built on a part of a hydro plant site.

Station heat rate is 13,026 Btu per kwhr on straight coal firing and 12,035 Btu per kwhr on the combined cycle. The latter raises efficiency 26.2 to 28.4%. On full load, station efficiency on the combined cycle is 29.2%. Station service power is reduced from 7.02 to 4.70% of the output with the combined cycle. The gas turbine can be put on the line in 20 min and loaded in another 5 min, said Sinclair.

Line construction costs can be reduced and its appearances improved through messenger-supported, mid-span services, said W. F. Cox, Nashville Electric Service. Customers who can not be served from the transformer pole, can be reached by running triplex services along a ⅜-in. galvanized steel messenger with a direct take-off to the customer service. This design requires fewer poles. Poles are set on every fourth lot line instead of every other lot line, and every poll has a transformer.

Discuss Splicing

To improve service reliability and solve tree trimming problems the Jacksonville (Fla.) Utilities System uses a design with Neoprene-covered primaries and triplex aluminum secondaries. Services are attached to the ACSR neutral at a point 20 in. from the pole, allowing ample climbing space. The report, by Cyrus Washburn, was read by George R. Parker, Chattanooga.

Developments for splicing rubber-insulated cables will include resin-impregnated, fiber-glass tape, predicted Merrit Bushby, superintendent of municipal utilities, Waverly, Iowa. Improved service reliability, savings through fewer troubles, and the fact that it can be installed without excessive tree trimming were some advantages of aerial cable, he reported. In 1958, about two miles of 5-kv and of 15-kv aerial cable were installed, some of each on the same pole line, he said.

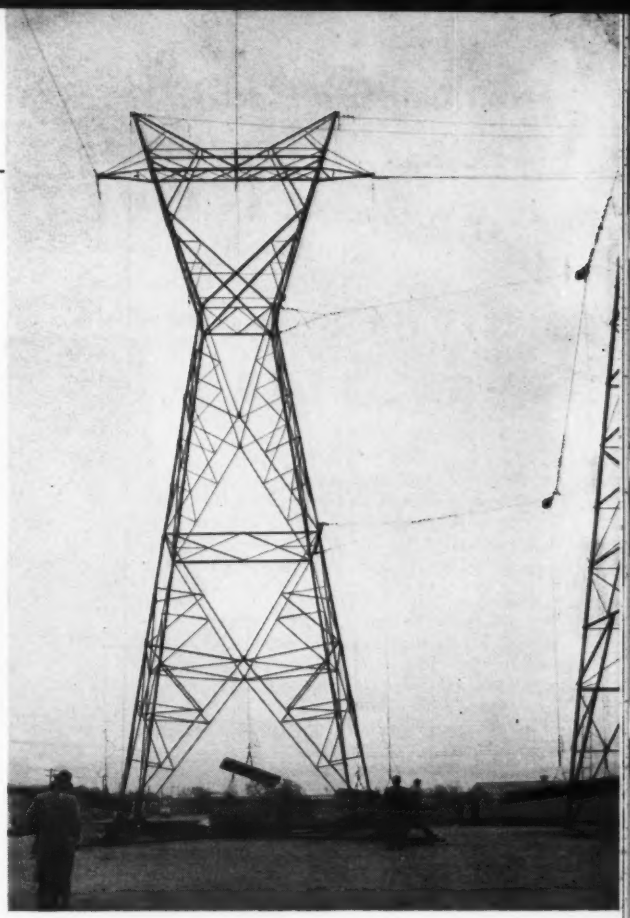
Two types of splices and terminations were used. One was conventional, using high-voltage rubber tape and cement; the other the resin pressure splice. For the latter the cable is prepared and connected in the usual way. A plastic screen spacer tape is applied. When an injection fitting has been placed over the spacer tape near the center, the splice is wrapped with a plastic tape envelope. As the envelope stretches under pressure of the resin, a restricting tape is applied over the plastic tape. Resin is applied by a pressure gun until the splice is filled. The check valve on the pressure fitting is then closed.

When the Eugene (Ore.) Water & Electric Board installed an underground network in the downtown business district, manholes and vaults were installed in precast sections, said H. D. Axtell. This procedure greatly reduced the time streets were open. Soapstone ducts were installed.

The network is fed through 4-500 MCM, 12-kv main primary feeders with 250-MCM laterals and 1/0 transformer taps. For the most part, primary cables are butyl insulated with a polyvinyl chloride jacket.

Manufacturers News

New Tower Designs Aim at Lower Costs



Two intriguing designs of light-weight towers promise attractive reductions in transmission line costs. One tower, made by Anchor Metals, features special structural steels. The other is a unique V-shaped aluminum tower designed by Aluminum Co of Canada.

The new light-weight low-cost steel transmission tower at the right was recently proved in rigid structural tests. The tower, weighing only one-third to one-half as much as equivalent conventional steel towers, is claimed by Anchor Metals to compare favorably in cost-per-mile to wood H-frame lines. Anchor designed, fabricated, tested the tower at its Hurst, Tex., plant.

The tower, designed to carry 138-kv single-circuit lines up to 795 MCM, weighs only 4,162 lb without footings. Use of high elastic grade and standard A-7 steel was said to be the key to its light-weight.

The structure is 68½ ft high to the crossarm and 75½ ft to the shield wire, with a 24-by-16-ft base.

During recent tests, Anchor reported, both transverse and longitudinal strength of the tower met maximum strains set forth in test specifications. Stringing tension was assumed in the design, but broken-arm assumption was eliminated. Detailed test reports on the tower test may be obtained from R. J. Van Somer, Anchor Metals, Hurst, Tex.

Transmission line costs are also expected to be slashed by a unique V-shaped single-footing aluminum tower designed by Aluminum Co of Canada for 345-kv.

The tower consists of a simple "V" with a crossbar on top. One phase conductor is suspended from the middle of the crossbar, the other two phases from either end. Two guys support each leg of the "V."

Alcan estimates that the V-shaped tower, in place and ready to be strung, will cost about 45% of the conventional tower. The structure is said to meet the same requirements as the conventional tower, both physically and electrically.

The Alcan tower weighs only 2,400 lb (compared to about 13,000 lb for a standard 345-kv tower), and the location of its single footing and four guy anchorages is not critical. Thus, the expensive problem of accurate installation and control of tower footings, particularly in rough country, is completely eliminated. The light weight will also produce savings in transportation and erection.

Four of the V-shaped towers are being tried out on a 345-kv line in rough and hilly country in the Province of Quebec. A fifth tower will be tested to destruction in May or June.

More than 60 all-aluminum transmission towers have already been programmed by Public Service Electric & Gas in cooperation with Aluminum Co of America (EW, Nov. 17, 1958, p 98). In addition, Alcoa reports, two other utilities are currently discussing the engineering of all-aluminum transmission tower lines.

Research Pushed for Coal-fired Gas Turbines for Utility Plants

Development of coal-burning gas turbines for utility power plants will be the objective of a research and development program to be conducted by the U.S. Bureau of Mines. A plant design which provides durability and economy for plants, longer life of turbine blades, better fly-ash control, and improved construction materials is expected to emerge.

The Bureau will use as experimental model a 4,200-hp gas-turbine loaned by the Locomotive Development Committee of Bituminous Coal Research, Inc. Also available are 125 coal-fired gas turbine locomotive patents for further research programs.

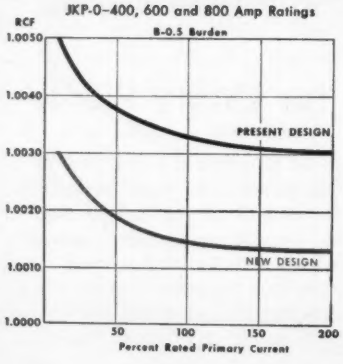
(*More Manufacturers News, p* 70)

From General Electric . . .

NEW DIMENSIONS in Cu

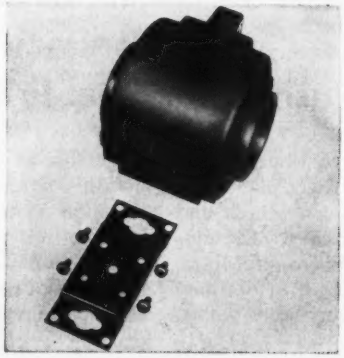
No
UP

ADDITIONAL PLUS FEATURES



HIGHER ACCURACY

In pacing industry trends toward better performance at higher loads, G-E engineers have improved JKP-O current transformer accuracy at higher burdens. New models now give 0.3 accuracy at B-0.1, B-0.2, and *B-0.5* in 400:5, 600:5, 800:5 ampere ratings.

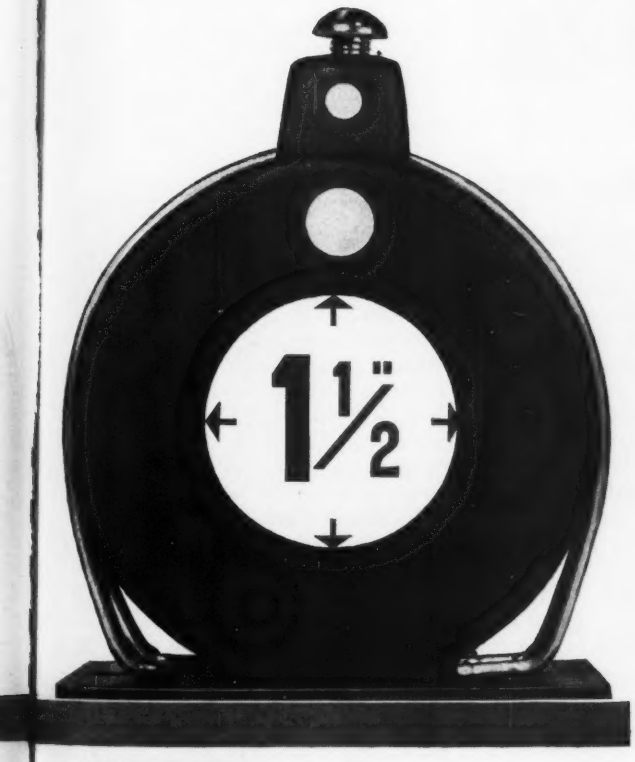


MAXIMUM MOUNTING FLEXIBILITY

Removable, stainless-steel base plates, held in place by four screws positioned in a square 1½ inches on center, can be rotated 90 degrees relative to the transformer. Consequently, JCA-O and JKP-O transformers can be individually- or gang-mounted more easily.

Current Transformer Design

Now, G-E Current Transformers Provide UP TO 50% MORE USABLE CABLE AREA



General Electric's line of job-proven 600-volt indoor-outdoor current transformers has taken on new dimensions. The window diameter on G.E.'s 200-amp JCA-O model has been increased from 1 inch to 1 3/16 inches. The 400-amp model window diameter has been increased from 1 5/16 inches to 1 1/2 inches.

In the General Electric JKP-O current transformer line, window diameters have been increased to 2 3/8 inches on 200-amp models and to 2 3/4 inches on the popular 400:5, 600:5, 800:5 models. These larger ratings will easily accommodate *two* 750 MCM cables or *three* 500 MCM cables. This window diameter increase provides up to 50% more area for cable installation.

In addition, the full circular G-E current transformer window opening permits: 1. easier cable insertion to reduce installation time; 2. better cable self-alignment within the window, thereby reducing the amount of mechanical stress and physical strain exerted on the transformer; 3. faster hook-up in restricted areas where cable must be wrapped in a small box.

Improved Design Provides Higher Accuracy, Greater Mounting Flexibility and Color-coding

In pacing industry trends toward better performance at higher loads, General Electric engineers have improved JKP-O current transformer accuracy at higher burdens. Both JCA-O and JKP-O transformers feature detachable, interchangeable base-plates which facilitate either individual or gang-mounting.

Oversize stainless-steel nameplates, color-coded in conformance with EIA standards, permit fast transformer identification in stock or in service. On JKP-O transformer nameplates, key current ratio numbers are printed large enough to be read at a distance of 60 feet.

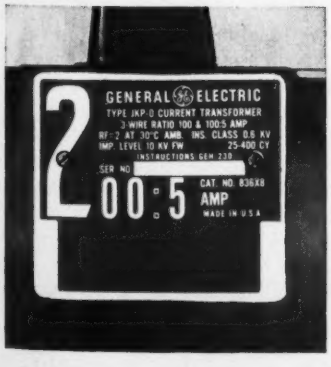
G-E Current Transformers Still Offer The Advantages of Butyl-molded Construction

General Electric current transformers are butyl-molded to assure long, low-maintenance service. Mechanically strong, butyl also acts as a tough, resilient moisture and oxidation-resistant insulation.

Primary and secondary polarity marks, permanently molded into the butyl casing and painted white, facilitate transformer installation.

Contact Your G-E Apparatus Sales Representative For Complete Ordering Information

Your General Electric apparatus salesman has complete ordering information on the new line of G-E JKP-O and JCA-O current transformers. He's ready to take your order right now! For more information on the new transformer models, write to Section 629-1, General Electric Company, Schenectady 5, New York.



COLOR-CODED NAMEPLATES

Stainless-steel nameplates, color-coded to EIA standards (red—200 amps, yellow—400 amps, blue—600 amps, grey—800 amps) permit quick transformer identification. On JKP-O models, key current ratio numbers can be read from a distance of 60 feet.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Penn Power Plays Host to Manufacturer

Pennsylvania Power was host to employees of Westinghouse Electric's Transformer Division during recent tour of New Castle Power Plant facilities. A staff of experienced utility personnel guided over 100 of the visitors through the station, showing them equipment and procedure. Boilers, turbo-generators, pumps, control panels, coal-handling equipment, purifiers, and condensers were inspected, and the hosts were besieged with questions.

Visitors were told that the drop in average price per kwhr for residential electricity—from 3.73¢ in 1939 to 2.6¢ at present—is accounted for by technical advances and operational efficiency. It was pointed out that greater use of electricity in today's homes plays major part in reducing rate.

MANUFACTURERS BRIEFS

Recent mergers . . . In acquiring H. H. Buggie, Inc, Toledo, Ohio, on May 1, **Burndy Corp** will broaden its electronic connector line. President Bern Dibner estimates Burndy's current annual sales of $24-million should be boosted $3½-million by the additional marketing potential . . . Negotiations are concluded by **Combustion Engineering** to make General Nuclear Engineering a subsidiary. Dr. Walter H. Zinn, who established and headed GNE, is vp of Combustion, in charge of nuclear power . . . Acquisition of Economy Fuse & Mfg by **Federal Pacific Electric** adds three U.S. plants and one in Canada to FP's 19.

Revamping of **General Electric's** Instrument Dept aligns responsibility for specific industries and market areas, replaces product-oriented setup. J. E. McQuillan heads Electric & Indust. Instruments Sales; H. S. Day, Instrumentation Equip. Sales & Product Planning . . . **Kaiser Aluminum** will transfer its general sales offices from Chicago to Oakland, Calif. . . . **Sylvania** will market a closed-circuit television system "designed and priced to meet 85% of demand for standard equipment." Unit, "priced well below most custom-designed systems" is expected to lift price block found by market research to deter sales to industrial concerns. TV camera uses three lenses in turret mount, but may be sold with only one.

Babcock & Wilcox and **De Laval Steam Turbine** are supplying, respectively, a nuclear reactor system and turbine-generating equipment for the N. S. Savannah, the first atomic surface vessel . . . Eight-lb reduction in weight of 50-kvar capacitors in stainless steel cases, **General Electric** says, makes them lightest on the market. Capacitors for 2400 to 4160-v weigh 106 lb less in the new design, those of 4800 to 7960-v weigh 107 lb less.

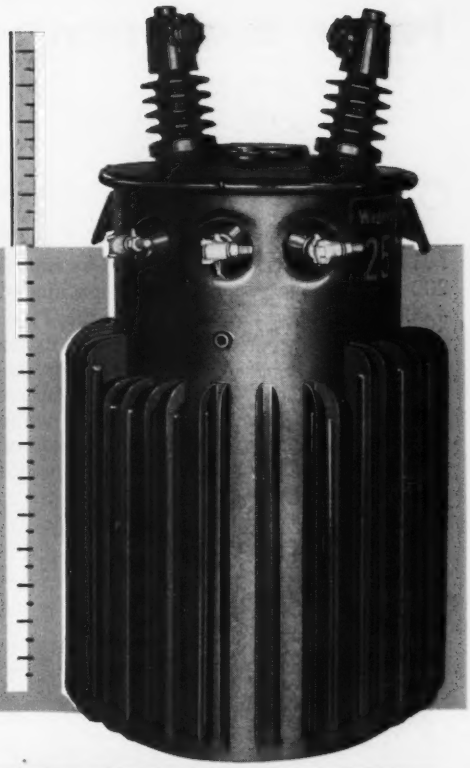
Niagara Mohawk plans to install a high speed, completely transistorized, electronic data processing system for the purpose of increasing the speed and efficiency of its customer accounting operations. The utility recently signed a lease agreement with **Radio Corp of America,** the developer and manufacturer of the RCA 501 system. Niagara Mohawk also plans an eventual wider use of the equipment in other phases of its business.

GE Installs Balance Testing Facility

Construction of a $600,000 steam turbine balance test facility is on General Electric's docket for its Medium Steam Turbine, Generator and Gear Dept in Lynn, Mass. Scheduled for late fall completion, it will be used to test steam turbines at speeds up to 10,000 rpm.

An existing structure will house the balance installation. A reinforced concrete room will be built, with steel-plated, 3-ft-thick walls affording maximum protection. Inside a vacuum steel tunnel, turbines will be tested with a new balancing attachment, which has spring bar mounts for balancing and a vectometer indicator head which gives the position of inbalance. Balancing will be performed at, or adjacent to, the plane of unbalance as well as in the ends of the turbine and at various points along the shaft to provide more smooth operation.

You get these Extra Values with Wagner Form W Transformers



Smaller size than ever before

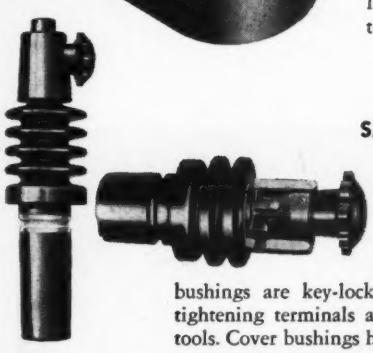
Wagner's line of single phase pole-type distribution transformers has been redesigned to give you extra value from your transformer investment. One result of this redesign is a substantial reduction in size. The 25 kva Type HEK Transformer, for example, is now only 37 inches high —including the cover mounted bushings!

LOWER EXCITING CURRENT

The improved quality annealed steel core used in these transformers provides a low reluctance path for the magnetic lines of force to result in much lower exciting current. Lower impedance, better ratio of losses, and improved regulation have also been achieved.

LONGER LASTING TANK FINISH

A new formula anti-corrosive paint is hot spray applied on tank sizes below 50 kva—flow coated on larger sizes. A primer coat, intermediate coat and finish coat are each cured by running the tanks through a tunnel of infra-red lamps or through controlled heat chambers. The result is a "Sure Seal" finish that withstands all temperature changes—is much longer lasting in corrosive atmospheres.



SAFETY-KEYED BUSHINGS

Heavy wet process porcelain high voltage bushings are safety-keyed. All terminals are key-locked in the bushing porcelain—sidewall bushings are key-locked in the tank wall. Hand tightening terminals are easily hooked up without tools. Cover bushings have insulated terminal guards to prevent outages caused by birds or animals. All bushing terminals are suitable for use with either aluminum or copper conductor.

The complete line of pole-type transformers, from 3 to 167 kva is available from stock to meet your distribution system requirements.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

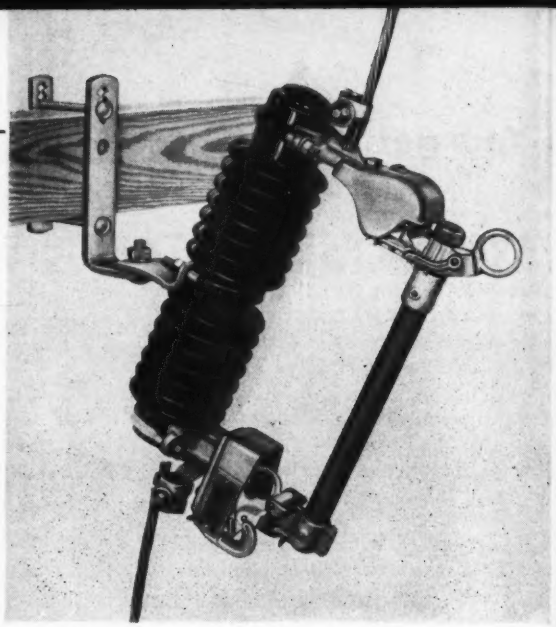
6456 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL . . . AUTOMOTIVE*

WT59-4

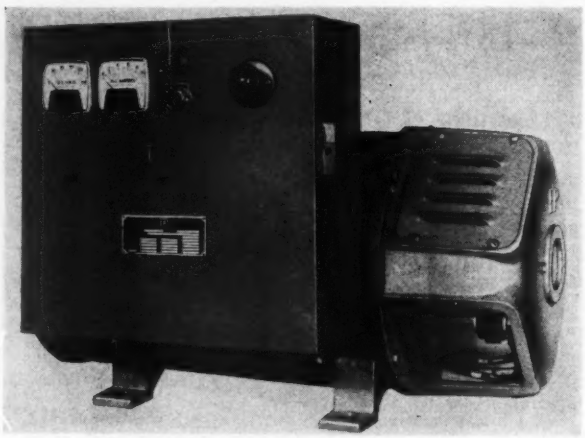
New Equipment

(For additional information, use Reader Service form, p 80)



Cutout . . .

. . . is available in 5.2, 7.8 and 15-kv ratings; 100 and 200-amp ratings. Interrupting capacities range from 4,000 to 12,000 amp. Known as the Type "F2", the drop-out open-type cutout features the extensive use of bronze, parallel-groove-design terminals, and expendable caps. All hardware forward of the insulator-clamping bolts and terminals, except for a number of small stainless steel screws and springs, is made of bronze to assure performance under corrosive conditions.
A. B. Chance Co, Centralia, Mo.



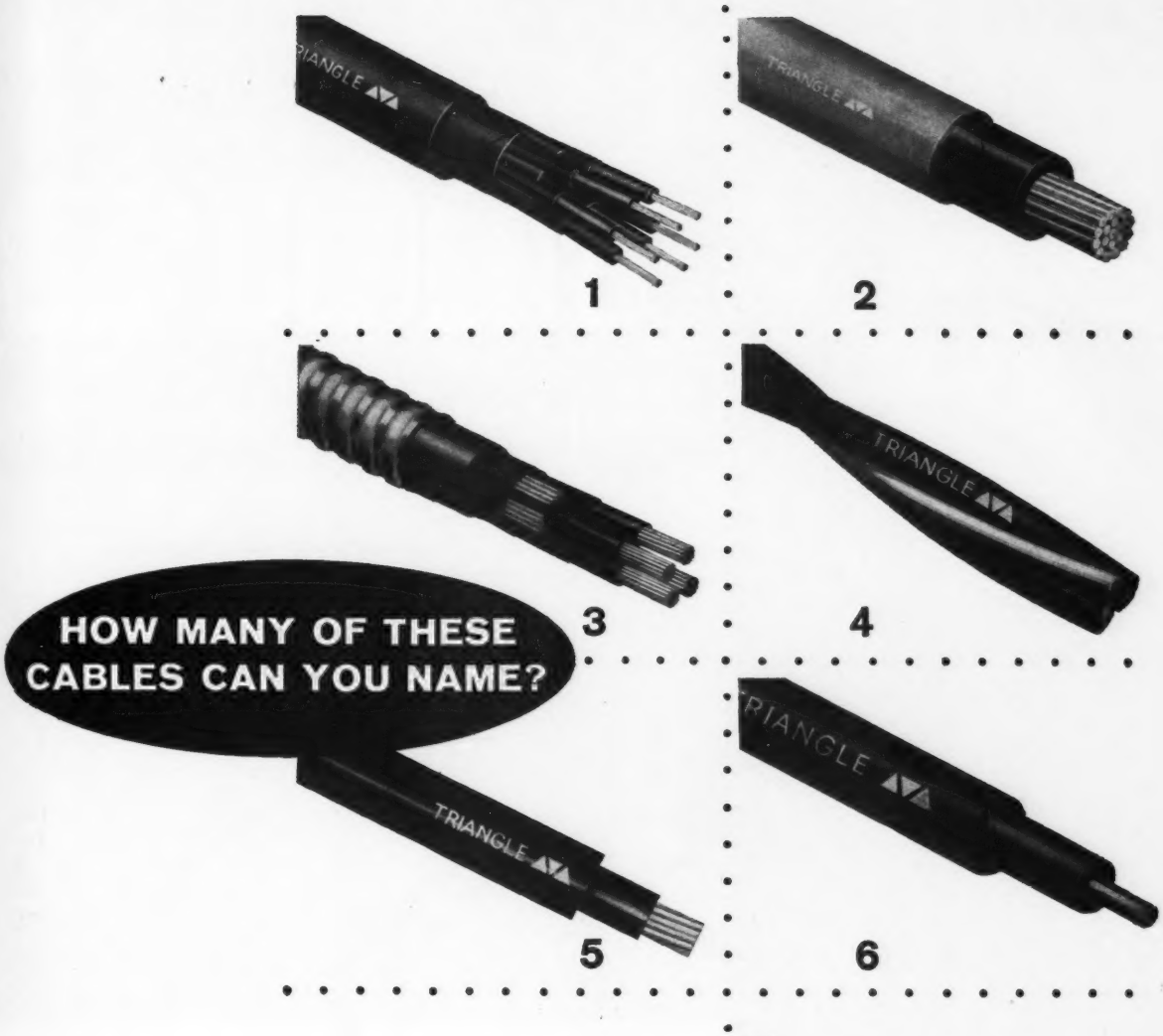
Battery Chargers . . .

. . . have generator, motor and control panel integrated into one unit. Savings are up to 42% in cost and 34% in floor space over comparable models with separately mounted components. The line of Electric Products chargers utilize the diverter-pole armature design. Seven models of the constant-voltage chargers are available with ratings ranging from 1 to 10 kw and with rotating speeds of either 1,800 or 1,200 rpm.
Exide Industrial Div, Electric Storage Battery Co, Rising Sun and Adams Aves, Philadelphia 20, Pa.

Recorder-Controllers . . .

. . . feature D-Pak constant voltage supply unit that eliminates batteries, standard cells and standardizing mechanisms in potentiometers. The circular-chart recorder-controllers are available with either electric or pneumatic controls. Interchangeable slide wires, replaceable range standards, plug-in amplifiers and universal mountings are other features of the equipment.
Daystrom-Weston Industrial Div, Daystrom, Inc, Newark 12, N. J.

(More New Equipment on page 76)



These six are only a few of the many types in the Triangle line of Power, Control and Lighting Cables for utilities. How many can you name without peeking at the bottom of the page?

You've probably specified these types many times – more and more utility engineers are doing that these days. They've become convinced that Triangle, a long time leader in the building wire and conduit field, can and does turn out control, network and service drop cables of the same high quality. Triangle products "must be right"—they must meet all specifications with plenty to spare.

Why don't you find out more about these and other cables in the broad Triangle line. Write for complete literature which is available to answer your specific inquiry.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

"It MUST Be Right!"

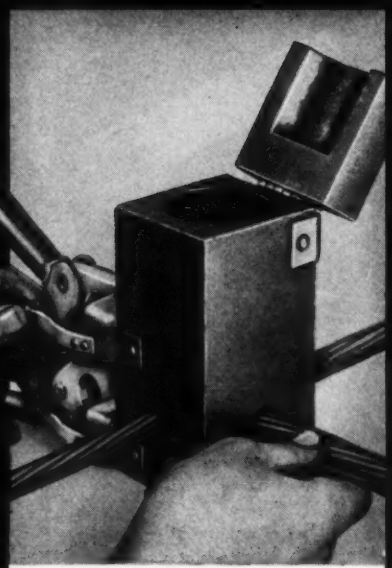
1 Control Cable 2 Varnished Cambric Lead Covered Power Cable 3 Interlocked Armor Power Cable 4 Neutral Supported Secondary Network Cable (Triplex) 5 RR Cable 6 Series Street Lighting Cable

Now you can weld a perfect, permanent electrica co

BURNDY

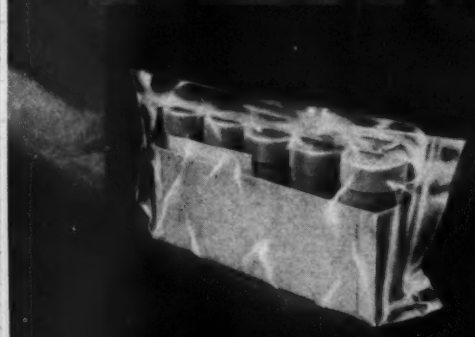
therm

to any copper conductor or steel str



WELD ANYWHERE, TO CABLE OR FLAT, WITH THIS COMPACT, LIGHTWEIGHT THERMOMOLD. Completely self-contained...needs no external source of power, no special skill. Mold fits over conductors, clamps cable in the right position.

JUST POUR WELDING POWDER INTO MOLD, TAP TO RELEASE STARTING CHARGE. Unique composition of starting charge prevents mixing with welding powder, assures positive firing. Exclusive welding powder formula produces easily removed slag.



THERMOWELD works everytime — no misfires.

Plastic cartridges have moisture-tight caps. Sealed polyethylene envelope with moisture absorbing silica gel keeps powder perfectly dry. Starting powder won't mix with welding charge, even if cartridges are shipped or stored upside down ...full starting charge assures positive ignition of welding powder.

ASK YOUR BURNDY DISTRIBUTOR OR REPRESEN TATI

BUR

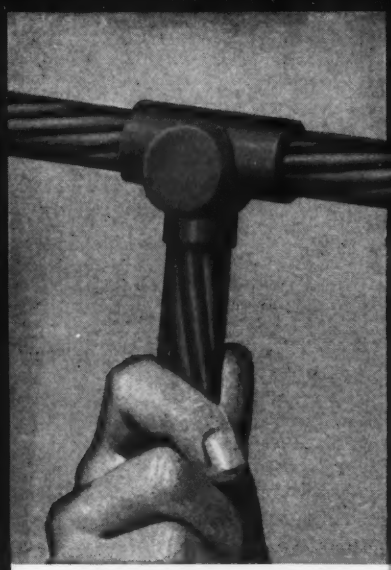
ELECTRICAL

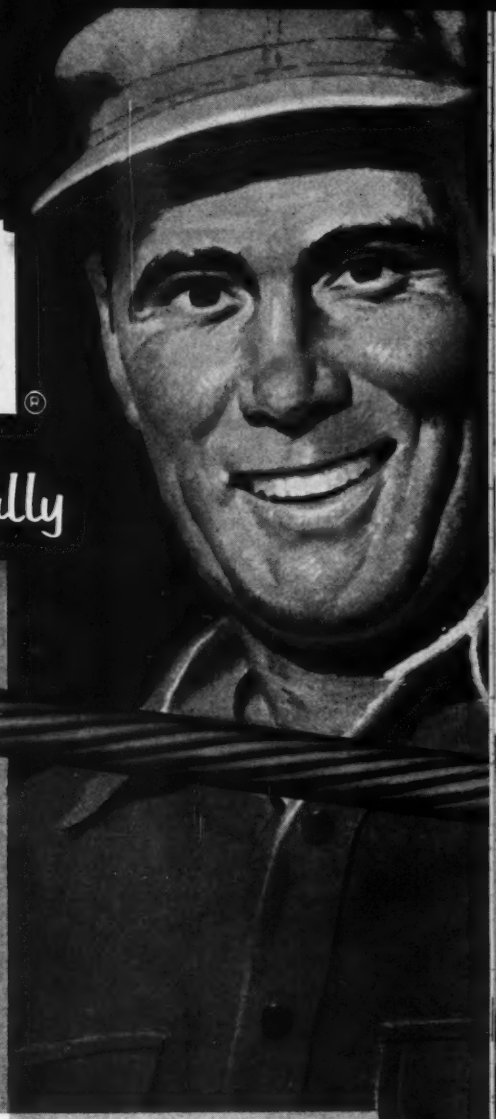
Norwalk, Connect. In Euro

connection every time with

O weld®

structure... easily and economically

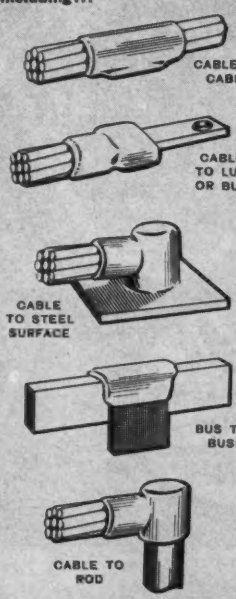




CLOSE COVER AND IGNITE CHARGE WITH FLINT GUN. Fast-burning powder fires every time. THERMOWELD reaction forms liquid, superheated copper which flows over and around conductors, fusing them into solid copper weld of 100% greater cross-sectional area than cable.

GET A PERFECT, PERMANENT THERMOWELD CONNECTION QUICKLY. Current-carrying capacity greater than conductors themselves. Connection is completely moisture proof, never corrodes or loosens, costs little to install, good for the life of the conductors.

You can THERMOWELD almost all steel or copper connections, including...



TATIVE FOR A DEMONSTRATION...OR WRITE

VERSATILE THERMOWELD makes cable—#4 thru 2,000 Mcm—lug, bus and flat surface connections

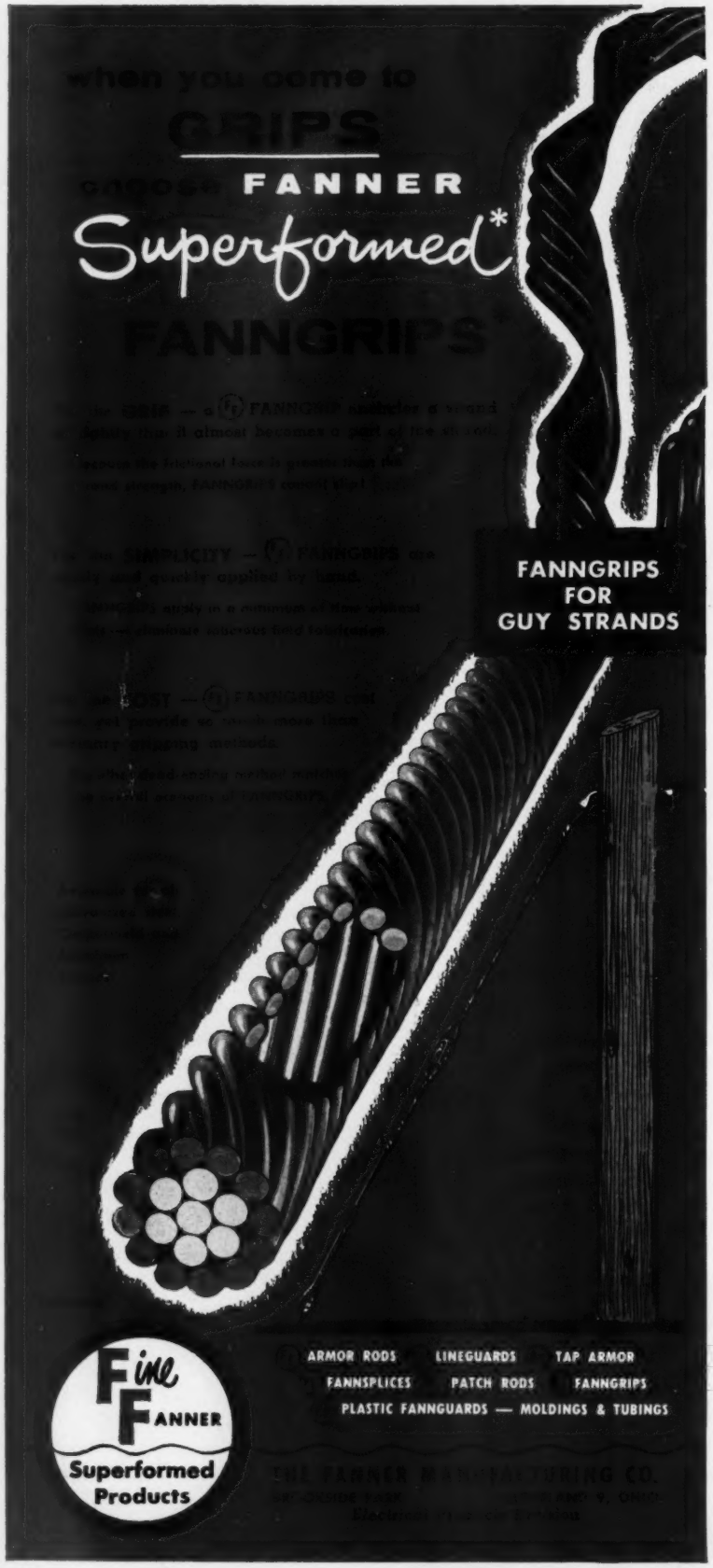
NDY

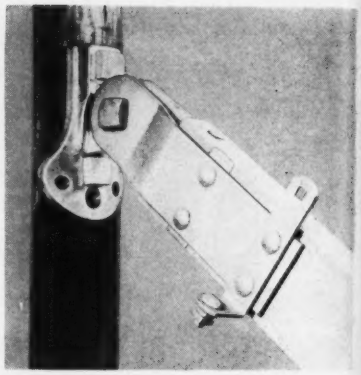
59-5

CONNECTIONS

Antwerp, Belgium

Toronto, Canada





Pole Eye Plate . . .

. . . holds clevis end of strain insulator so that the clevis pin is placed in double shear. Identified by Catalog No. PX88, the plate can be mounted in a variety of ways. The load can be applied at any angle between 10 and 90 degrees, and rated capacity is 20,000 lb. The wood contacting surface of the plate is equipped with integral teeth that help resist the vertical load on guying installations.

Malleable Iron Fittings Co, Branford, Conn.

Brush Killer . . .

. . . gives positive control with one treatment. The chemical, known as "Dybar", is marketed in the form of pellets. Successful control of 22 species of plants in all areas east of the Rockies has been accomplished. "Dybar" can be scattered by hand, mechanically or by airplane. Being non-volatile, it can be used near sensitive crops. It is non-corrosive, non-flammable and presents no toxicity hazards to people or animals when used as directed.

E. I. du Pont de Nemours & Co, Wilmington, Del.

Hangers . . .

. . . for 100-kvar capacitors are made from aluminum. They are designed for the standard mounting dimension of 15⅝ in. The lightweight single-unit hanger can be mounted on a pole, wall or crossarm. The three-unit hanger shown is designed for crossarm mounting only. Each hanger is furnished with

(*Continued on page* 78)

Specialized Experience
gained in serving 46 of the nation's leading power companies in 22 states.

Complete Facilities
for fabrication and erection of structural steel and plate work.

Skill and Craftsmanship
to meet every special requirement of power plant construction—on schedule, economically.

Unit number 4, Green River Power Station, Green River, Ky.
Owner: Kentucky Utilities Co.
Engineers: Sargent and Lundy
Structural Steel: The Ingalls Iron Works Company
Stack: Birmingham Tank Division
Erection: The Ingalls Steel Construction Company

For detailed information or technical assistance, call Ingalls now.

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COMPANY
Executive Offices
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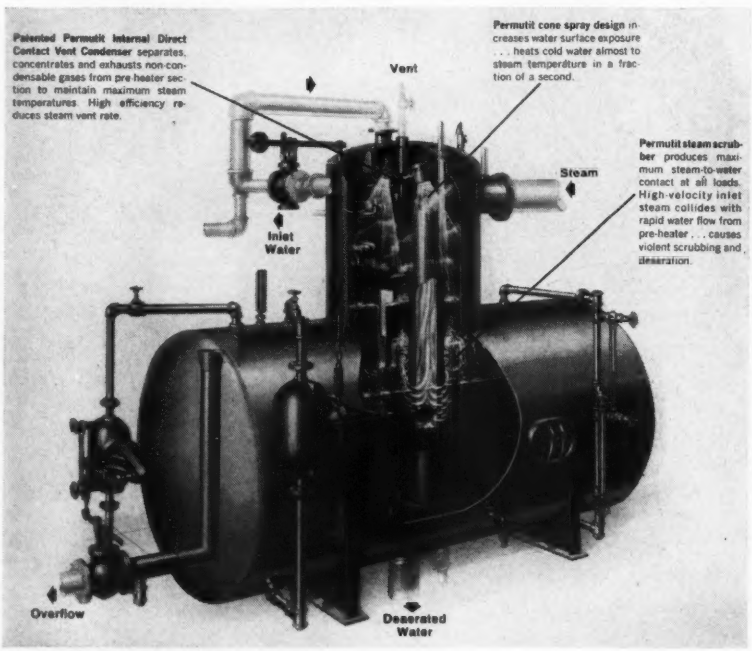
INGALLS INDUSTRIES ARE:
The Ingalls Iron Works Company, Sales Offices: New York, Pittsburgh, Chicago, Houston, New Orleans, Atlanta. • **The Ingalls Steel Construction Company,** Sales Offices: New York, Chicago, New Orleans, Pittsburgh, Houston, Atlanta • **Birmingham Tank Division,** Sales Offices: New York, Pittsburgh, Chicago, Atlanta, New Orleans, Pascagoula **The Ingalls Shipbuilding Corporation,** Shipyards: Pascagoula, Mississippi; Decatur, Alabama • Sales Offices: New York, Chicago, Washington, Houston, New Orleans, Atlanta

FLUIDICS

is a Pfaudler Permutit program providing
the know-how
the equipment
and the experience
for solving problems involving fluids.


Patented Permutit Internal Direct Contact Vent Condenser separates, concentrates and exhausts non-condensable gases from pre-heater section to maintain maximum steam temperatures. High efficiency reduces steam vent rate.
Vent
Permutit cone spray design increases water surface exposure . . . heats cold water almost to steam temperature in a fraction of a second.
Steam
Permutit steam scrubber produces maximum steam-to-water contact at all loads. High-velocity inlet steam collides with rapid water flow from pre-heater . . . causes violent scrubbing and deaeration.
Inlet Water
Overflow
Deaerated Water

FLUIDICS AT WORK

New deaerators guarantee less than 0.005 ml/l oxygen at all loads

This is the new Permutit Type B Deaerator. Both horizontal and vertical designs hold oxygen to 0.005 ml/l at all loads up to a peak of 150,000 lbs/hr.

No trays to be removed or cleaned. Tubeless internal vent condenser eliminates tube cleaning, also.

30,000, 50,000, and 70,000-lbs/hr horizontal units are available from stock. They come as packaged units with all internals, including sprays, completely assembled. Pre-fitted float-cage and gauge-glass piping further simplify installation.

Capacities from 150,000 to as much as 3,000,000 lbs/hr are available in Permutit Type A Deaerators.

For more information, write to our Permutit Division, Dept. EW-39, 50 West 44th St., New York 36, N.Y.

Fluidics covers such varied phases of fluid handling and control as:

corrosioneering	drying
water treatment	blending
waste treatment	metering
reactions	valving
ion exchange	piping
gas analysis	pumping
agitation	storing

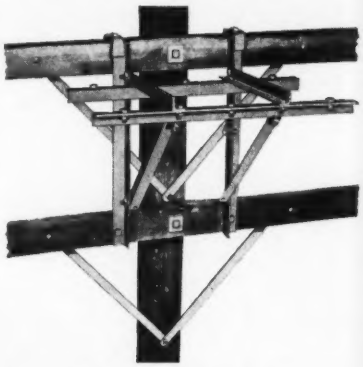
Whenever you have a fluid-handling problem, look to this Pfaudler Permutit FLUIDICS program for the best solution.

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . . the science of fluid processes

Hangers . . .

(*Continued from page* 76)



a ground clamp. The clamp accommodates either aluminum or copper conductor from No. 8 solid through No. 1 stranded.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Current Transformers . . .

. . . have increased cable capacity. The Type JCA-O and JKP-O 600-v CT's are butyl molded and used with watthour meters on indoor or outdoor applications. The units have color-coded nameplates for ready identification of current ratings. Type JCA-O is available in 200 and 400-amp ratings, 60-400 cps; Type JKP-O in 200, 400, 600 and 800-amp ratings, 25-400 cps.

General Electric Co, Schenectady 5, N. Y.

Cutout Cover . . .

. . . was inadvertently described in the March 2, 1959, issue of Electrical World as being of the 7.5-8 kv class and protecting from —40C to +170C. The plastic unit is of the 15-kv class and protects from —40F to +170F.

Starline Co, 119 Franklin St, Dayton 2, Ohio.

KEEP PACE WITH COMMUNITY GROWTH!

Use VICTOR DISTRIBUTION UNITS

VICTOR NO. 5R RADIO-FREED PINTYPE (EEI-NEMA 55-3)

LOW VOLTAGE PINTYPES

No insulator is made with greater care than a VICTOR Distribution Pintype. They're made with the same Purified Porcelain as those designed to carry 230 KV and more. They're made with the same quality control as every other VICTOR insulator, and they all undergo the same careful routine electrical testing as our high voltage insulators. In other words, VICTOR Distribution Pintypes are premium grade.

RADIO TREATMENT YOU CAN SEE

The conductive glaze on VICTOR radio-freed pintypes is readily *distinguishable* and *permanent.* It is scientifically compounded for elimination of radio interference. Because VICTOR Pintypes are color coded, you know at a glance whether they are radio-freed. This may not seem like a very important feature. But when you have both in stock, it's mighty convenient for your linemen to pick out radio-treated from non radio-treated insulators easily and quickly. VICTOR radio-treated pintypes are available to you at no extra cost.

ACCURATE THREADS

Smooth, die-formed porcelain threads assure easy, fast installation. Unitized forming of insulator body and thread assures complete uniformity and accuracy of pin fit. This accuracy is constantly maintained by gauge testing.

VARIETY OF WIRE GROOVE AVAILABLE

VICTOR Distribution Pintypes may be ordered with top wire grooves to fit the conductor you are using. VICTOR No. 5 or 5R has the standard ⅜" radius top wire groove. VICTOR No. 6 or 6R and No. 9 or 9R are available with either standard ⅜" or 1" radius top wire groove.

VICTOR DEADEND SUSPENSIONS

VICTOR No. 804, 6" Suspensions and VICTOR No. 801, 7½" Suspensions are made-to-order for deadend work and where a conductor has to turn an angle. The No. 804 has a combined M & E rating of 10,000 lbs. and the No. 801

VICTOR NO. 804 6" SUSPENSION (EEI-NEMA 52-1)

an M & E rating of 15,000 lbs. Made of Purified Porcelain, with the same above-standard quality control manufacturing methods as all VICTOR Suspensions, they are built to withstand mechanical and electrical stresses far above their EEI-NEMA M & E ratings.

PINTYPES FOR CONTAMINATED AREAS

Several types of specialized pintype insulators are available for areas troubled with fog, smog, salt-laden air, chemical and industrial fumes. We call your attention particularly to our Nos. 33, 34, 134, and 135.

For full information regarding VICTOR Distribution Pintypes and Suspensions, write I-T-E Circuit Breaker Company, Victor Insulators Division, Victor, N.Y.

VICTOR FOGBOWL PINTYPE (NOS. 35, 36, 39 and 40)

VICTOR FOG PINTYPE (NOS. 33, 34, 134, 135)

I-T-E CIRCUIT BREAKER COMPANY

VICTOR INSULATORS DIVISION

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Chance .....Cutout
Exide .....Battery Charger
Daystrom .....Recorder
Malleable Iron .....Plate
du Pont .....Brush Killer
L-M .....Hangers
GE .....CT's

MANUFACTURERS LITERATURE

Code No. .....

(Requests are made from code numbers on page 101).

OTHER

Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

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99.6%
SUREP

Of all manufacturers of power capacitors only C-D puts each and every unit through a full voltage energization test before shipment to you. This is why C-D delivers an unbeatable 99.6%-sure performance

PERFORMANCE

in the field.

15, 25, 33.3, 50 and 100 KVAR capacitors for every application with lowest dielectric unit stress and highest major insulation level. Invest your purchasing dollar in internal quality—the only place where it counts. See your C-D representative or write Cornell-Dubilier Electric Corp., Dept. EW-39, South Plainfield, N. J.

SPECIFY

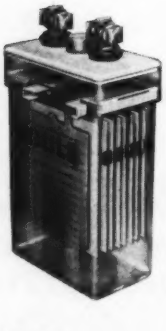
*C*onsistently *D*ependable

CORNELL-DUBILIER

POWER-FACTOR CAPACITORS

Peak power when the going's rough

... **gould** *batteries*



America's Finest!
GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

The ability to "take it" day in and day out . . . *and still deliver peak power* is an important characteristic of Gould Batteries.

This dependability is carefully designed into every Gould Battery. It's the result of constant research and attention to detail by Gould engineers. Every new feature added to Gould Batteries, for example, must test out in *production* as well as in the laboratory. This way you are sure that *every* Gould Battery you buy will give you the dependable performance you have learned to expect from Gould.

Call your local Gould representative for details. No obligation. He's listed under "Batteries, Industrial" in the yellow pages. Gould-National Batteries, Inc., Trenton 7, N. J.

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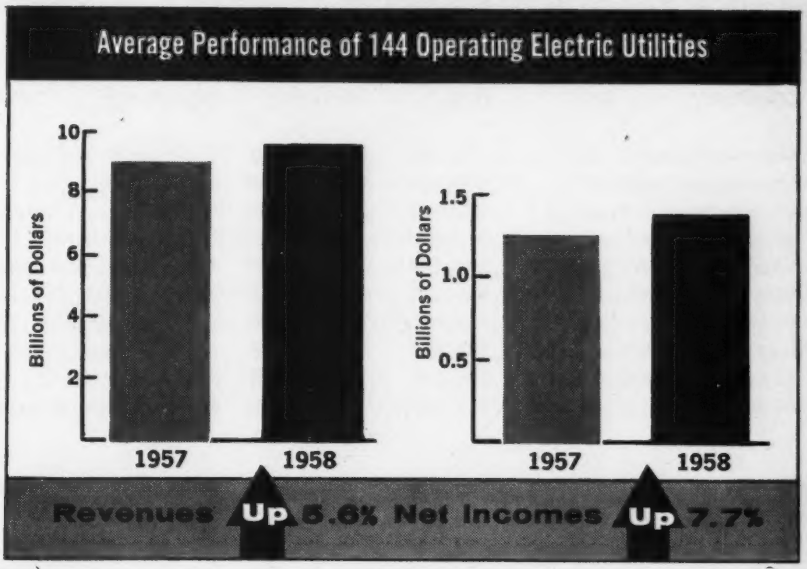
Always Use Gould-National Automobile and Truck Batteries

More Power to you from Gould

Here Are Net Incomes for 144



Report on
Utility Earnings

1958 Net Incomes Jump 7.7%

Power companies' 1958 net incomes rose an average of 7.7% over 1957, according to EW's calculations based on a 144-company sample. Operating revenues rose 5.6%. Increased rates, economies of operation, and good hydro conditions all helped utility earnings in a year whose first half was marred by recession.

Leading region was the Pacific, with an average net income increase of 15%. Helped by rate hikes, Pacific Gas & Electric Co and Southern California Edison Co did more than their share, each earning about $8½ million more in 1958 than in 1957. Second place for regional honors went to the East South Central region (Alabama, Mississippi, Kentucky, and Tennessee) with a 13% average gain. The South Atlantic region averaged 9.7%, followed in order by New England (9.1%), Middle Atlantic (8.9%), West South Central (8.5%), Mountain (7.9%), East North Central (3.4%), and West North Central (0.4%).

Florida continued its rapid earnings growth. The four largest Florida companies upped their net by an average of more than 18%, led by Florida Power & Light Co with a 21.5% increase. The Texas average grew at a slower rate—8.1% for the average of 11 companies. But the crown for fastest net income growth over 1957 goes to Vermont. Both Green Mountain Power Co and Central Vermont Public Service Co bounced back from a bad 1957 and boosted 1958 earnings by more than 20%. Central Vermont credited better water conditions, cutbacks in maintenance, and the availability of St. Lawrence power.

Biggest absolute gain was recorded by Commonwealth Edison Co. Both PG&E and Consolidated Edison Co of New York turned in bigger net incomes, but Commonwealth Ed upped earnings by more than $10 million to PG&E's $8,690,000 and Con Ed's $8,659,280.

New England produced the two largest percent increases in net. Aided by a long-awaited rate hike, Housatonic Public Service Corp improved its earnings by no less than 77.2%; and Newport Electric Corp raised its net by 42.5%. In

4 Operating Electric Utilities

Here Are Net Incomes for 144

COMPANY	1958	1957	COMPANY	1958	1957
Alabama Power(a)	$18,570,374	$16,975,367	Fall River Electric Light(b)	$ 826,534	$ 764,822
Appalachian Electric(a)	19,419,064	18,336,163	Florida Power	11,166,217	9,369,751
Arkansas-Missouri Power	1,240,093	1,223,698	Florida Power & Light	24,773,027	20,394,478
Arizona Public Service	8,204,000	7,441,000	Georgia Power(a)	19,501,140	17,960,906
Arkansas Power & Light(a)	8,293,524	8,355,647	Green Mountain Power	739,466	596,975
Atlantic City Electric	5,856,953	5,150,952	Gulf Power(a)	3,195,943	3,064,047
Baltimore Gas & Electric	17,925,000	17,550,000	Gulf States Utilities	14,076,404	11,759,236
Bangor Hydro-Electric	1,197,477	1,080,895	Hartford Electric Light	7,269,000	6,962,000
Blackstone Valley G & E(b)	1,824,148	1,625,929	Housatonic P S	914,095	515,933
Boston Edison	10,952,075	9,230,660	Houston Lighting & Power	20,208,137	18,946,566
Brockton Edison	1,392,142	1,177,613	Idaho Power	8,085,284	6,426,978
California Electric Power	4,909,235	3,802,164	Illinois Power	15,566,368	14,599,192
California-Pacific Utilities	882,545	911,387	Indiana & Mich. Elec(a)	10,627,226	10,158,731
Carolina Power & Light	12,274,283	11,492,530	Indianapolis Power & Light	8,420,533	7,838,291
Central Hudson G & E	4,203,892	4,014,355	Interstate Power	3,969,565	3,711,676
Central Illinois Electric & Gas	3,393,651	3,189,382	Iowa Electric Light & Power	4,255,981	4,276,143
Central Illinois Light	5,263,140	5,395,582	Iowa-Illinois Gas & Electric	5,317,574	5,634,680
Central Illinois Public Service	9,942,899	9,652,141	Iowa Power & Light	4,974,422	4,844,242
Central Louisiana Electric	2,980,657	2,694,071	Iowa Public Service	3,905,755	3,857,124
Central Maine Power	6,525,171	6,917,473	Iowa Southern Utilities	1,735,662	1,698,380
Central Power & Light(a)	9,479,196	9,014,901	Jersey Central P & L(a)	6,779,464	5,817,721
Central Vermont P S	1,640,812	1,344,893	Kansas City Power & Light	10,158,199	9,877,486
Cincinnati Gas & Electric	15,757,355	15,556,718	Kansas Gas & Electric	6,474,332	6,075,632
Cleveland Electric Illum	18,680,183	18,901,160	Kansas Power & Light	7,141,273	7,000,616
Colorado Central Power	700,608	580,157	Kentucky Power(a)	1,424,235	1,336,555
Columbus & Southern Ohio	6,692,637	7,794,026	Kentucky Utilities	7,272,826	5,750,632
Commonwealth Edison	63,502,223	53,342,448	Kingsport Utilities(a)	425,281	445,802
Community Public Service	1,626,984	1,600,002	Long Island Lighting	14,689,545	12,581,313
Connecticut Light & Power	12,708,892	11,258,318	Louisiana Power & Light(a)	6,973,369	6,002,145
Consolidated Edison of N. Y.	65,357,119	56,697,839	Louisville Gas & Electric	9,192,704	7,748,911
Consumers Power	31,524,062	32,763,015	Lynn Gas & Electric(b)	854,000	900,000
Dallas Power & Light(b)	8,968,796	8,250,590	Maine Public Service	748,509	660,215
Dayton Power & Light	10,542,000	10,315,000	Merrimack-Essex Elec.(b)	1,859,000	1,974,000
Delaware Power & Light	7,447,020	7,201,951	Metropolitan Edison(a)	8,729,842	8,282,675
Detroit Edison	30,101,310	32,718,555	Minnesota Power & Light	4,579,136	4,860,728
Duke Power	22,859,000	20,888,000	Mississippi Power(a)	3,175,935	3,108,462
Duquesne Light	20,928,605	20,432,135	Mississippi Power & Light(a)	5,039,510	4,536,904
Edison Sault Electric	301,060	296,281	Missouri Power & Light(a)	1,727,000	1,303,002
El Paso Electric	3,341,695	2,976,088	Missouri Public Service	2,100,733	2,210,775
Empire District Electric	1,832,313	1,723,373	Missouri Utilities	623,132	660,127

Operating Electric Utilities*

COMPANY	1958	1957
Monongahela Power(a)	$6,342,158	$6,105,892
Montana Power	11,095,023	10,630,794
Narragansett Electric(a)	2,739,660	2,666,516
New England G & E(c)	3,958,006	3,707,509
New England Power(a)	9,175,000	7,458,000
New Jersey P & L(a)	2,636,980	2,469,871
New Orleans P S(b)	4,542,260	4,137,956
New York State E & G	14,589,298	11,715,801
Newport Electric	229,904	161,273
Niagara Mohawk Power	30,383,000	26,430,000
Northern Indiana PS	13,893,971	13,687,342
Northern States Pwr (Minn.)	22,077,371	21,161,801
Northern States Pwr (Wisc.)	3,265,843	2,927,006
Northwestern Public Service	1,063,809	1,000,441
Ohio Edison	25,718,883	25,856,623
Ohio Power(a)	20,369,093	19,734,614
Oklahoma Gas & Electric	11,186,218	9,724,044
Orange & Rockland Utilities	2,909,746	2,373,944
Otter Tail Power	2,038,119	1,930,963
Pacific Gas & Electric	85,310,000	76,620,000
Pacific Power & Light	11,731,000	9,705,000
Pennsylvania Electric(a)	16,046,302	14,872,530
Pennsylvania Power & Light	22,860,758	22,850,777
Philadelphia Electric	39,265,539	37,162,471
Portland General Electric	6,494,695	5,769,154
Potomac Edison(a)	5,240,338	4,800,992
Potomac Electric Power	10,629,243	10,054,307
Public Service Electric & Gas	35,310,089	34,384,882
Public Service of Indiana	16,363,378	15,102,456
Public Service of N. H.	4,658,213	4,834,826
Public Service of New Mex.	2,855,688	2,379,274
Puget Sound Power & Light	6,424,342	5,945,997
Quincy Electric(a)	160,000	190,000
Rochester Gas & Electric	7,470,705	6,740,149
San Diego Gas & Electric	6,611,801	6,527,353
St. Joseph Light & Power	1,056,234	1,132,078
Savannah Electric & Power	1,900,755	1,773,072
Sierra Pacific Power	1,642,296	1,523,008
South Carolina E & G	8,447,915	6,693,881
Southern California Edison	40,005,407	31,567,303
Southern Indiana G & E	$2,885,587	$2,744,639
Southern Nevada Power	1,085,207	1,041,075
Southwestern Electric(a)	6,811,925	6,401,477
Southwestern Public Service	8,780,570	8,487,207
Suburban Electric(b)	829,000	958,000
Tampa Electric	4,750,088	4,355,899
Texas Electric Service(a)	15,903,144	14,962,331
Texas Power & Light(a)	13,710,674	12,618,242
Toledo Edison	7,128,672	6,548,351
Tucson Gas Electric L & P	2,631,509	2,474,671
Union Electric	20,476,000	22,213,178
United Illuminating	4,823,420	4,521,798
Utah Power & Light	8,565,788	8,791,308
Virginia Electric & Power	26,323,095	24,502,536
Washington Water Power	6,210,497	5,704,734
West Penn Power(b)	14,093,307	14,331,566
West Texas Utilities(a)	4,388,578	4,225,214
Western Light & Telephone	1,793,580	1,750,695
Western Massachusetts	4,035,231	3,908,064
Wheeling Electric(a)	798,133	749,282
Wisconsin Electric Power	13,106,659	13,439,668
Wisconsin Power & Light	7,397,539	6,679,479
Wisconsin Public Service	5,770,670	5,485,515
Worcester County Elec(b)	2,456,000	2,240,000
Total—144 companies	**$1,450,400,585**	**$1,346,652,307**

(a)—All common shares owned by a holding company.
(b)—Most common shares owned by a holding company.
(c)—Holding company controlling 4 operating companies.

*

For the 12 months ended December 31, 1958 and December 31, 1957

Because not all companies previously listed in EW's 144-company sample had reported earnings at press time, a few substitutions have been made.

third place was Missouri Power & Light Co, with 32.5%, followed by California Electric Power Co (29.1%) and So Cal Ed (26.7%). Calectric points out that its earnings improvement was exaggerated by the adoption of flow-through accounting for accelerated depreciation benefits. This accounting change, the company says, was responsible for almost ⅔ of the reported growth.

Interest charged to construction swelled the net incomes of some big gainers. Idaho Power Corp's net was up by $1.6 million, as the completion of Brownlee cut power purchases and increased sales to other utilities; but interest charged to construction was up by just under $1.5 million. And Pacific Power & Light Co (with a 21% rise in net) hiked interest charged to construction by $500,000 more than its substantial rise in earnings.

These Ten Companies Made Largest Net-Income Gains

Company	Percent Increase
Housatonic Public Service	77.2
Newport Electric	42.5
Missouri Power & Light	32.5
California Electric Power	29.1
Southern California Edison	26.7
Kentucky Utilities	26.5
South Carolina Electric & Gas	26.2
Idaho Power	25.8
New York State Electric & Gas	24.5
Green Mountain Power	23.9

While These Ten Showed the Largest Declines

Company	Percent Decline
Quincy Electric	15.8
Columbus & Southern Ohio Electric	14.2
Suburban Electric	13.5
Detroit Edison	8.0
Union Electric	7.8
St. Joseph Light & Power	6.7
Minnesota Power & Light	5.8
Merrimack-Essex Electric	5.8
Central Maine Power	5.7
Iowa-Illinois Gas & Electric	5.6

Largest percent decline in net income was reported by Quincy Electric Co, of the New England Electric System, and NEES companies also showed the third and eighth largest declines. Net for the entire New England Electric System, however, was up a healthy 14.7% above 1957; and a rate hike granted last month assures better earnings for Quincy in 1959. Columbus & Southern Ohio Electric Co's net dropped 14.2% below 1957, owing partly to a $550,000 decline in interest charged to construction. The company still has a $3.4-million-a-year rate increase pending. Detroit Edison Co's net was off 8%, despite a $4-million cut in utility expenses. Revenues dropped $4.4 million, while interest costs rose almost $2 million. Union Electric Co's earnings picture was distorted in two directions: 1957 earnings had included $2.6 million in non-recurring profits from property sales, but an accounting change ordered by the PSC caused the addition of $1.3 million in deferred taxes to net income. Allowing for both influences, the company's net was still down. An $8-million-a-year rate increase is pending.

Iowa-Illinois Gas & Electric Co set up a milestone for investor-owned utilities, including in its income statement a $420,000 charge for "fair value" depreciation. In deciding a case involving gas rates for the city of Fort Dodge, the Iowa Supreme Court stated in September 1957 that the allowance for depreciation "should be based upon present value rather than on original cost." After rate increases were granted last spring in three Iowa districts, therefore, the company began charging $60,000 a month as "fair value" depreciation for these districts. The Iowa-Illinois annual report notes: "Depreciation is a fact regardless of the accounting—to the extent depreciation is understated, earnings are overstated . . . We hope that in time our income tax laws will recognize as a business deduction the full or 'economic' depreciation attributable to current operations." This realistic statement of depreciation caused Iowa-Illinois' net income to drop 5% below 1957. Had "fair value" depreciation gone unreported, the company's 1958 earnings would have shown a small increase.

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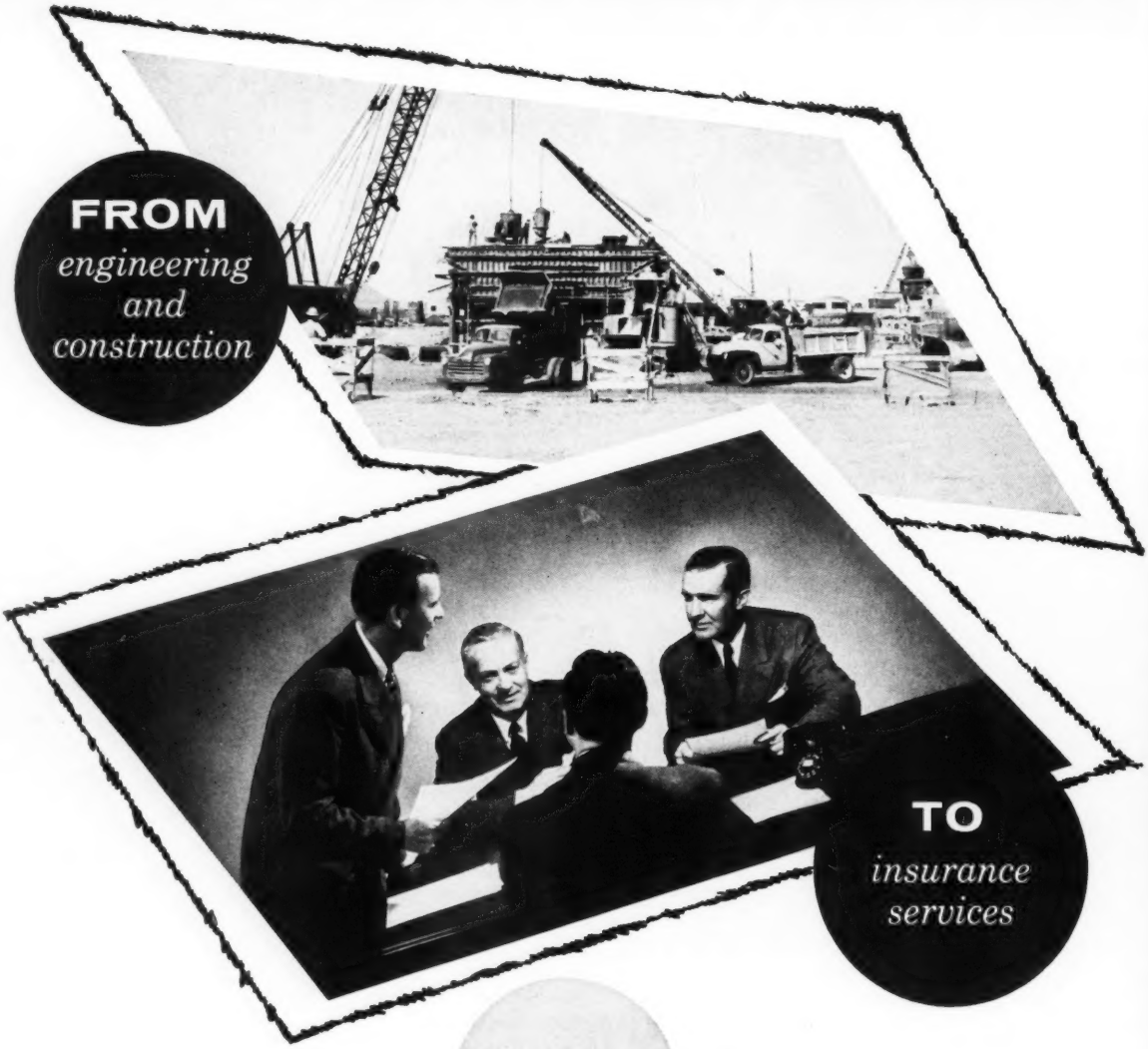

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Why Heat Pump Is Your Best Bet (*Continued from page 62*)

Electricity is the preferred fuel for cooking, water heating and space heating in custom-built homes, and in the conversion of equipment in older homes. It is also preferred in medium-priced and luxury tract homes.

However, experience indicates contractors tend to install gas equipment in lower-priced tract homes because of lower initial investment costs. Where gas is installed for space heating, it almost always gets water heating, and generally cooking.

Where heat pumps are installed for cooling and space heating, the home generally goes all-electric. For this reason the company is determined to retain a substantial portion of the space heating load in its service area.

Low Rates Help Push Electric Heating

Low electric rates, made possible by inexpensive hydro power, and high cost of competitive fuels early resulted in widespread electric space heating in Southern Nevada. At the end of 1953, approximately 80% of homes and businesses here had electric space heating.

Conditions changed radically in 1954, when natural gas came into the area at the time of a temporary shortage of electrical supply. Boom growth conditions in the Las Vegas area had used up the available cheap hydro power supply. The power company delayed too long in building steam-electric generation and was forced to ban new commercial heating load and install regulators on homes and apartments to limit residential usage.

As a result of these restrictions, and an aggressive gas company sales policy, all new commercial and practically all new residential customers installed gas for space heating during this period. The gas company was successful in urging new space heating customers also to use gas for water heating and cooking.

During this period, the power company was pressed to meet its customers' electric needs. It cancelled orders placed by previous management for a 30-Mw steam-electric generating unit and rushed installation of a 44-Mw unit. During construction it imported large amounts of steam-electric power from outside Nevada.

The following shows the extremely fast growth of the company during this period and the effect of natural gas competition on customer usage:

	Kwhr Sales	Percent Increase	Annual Kwhr Residential Customer Usage
1954	333,041,000	21%	9,821
1955	466,158,000	40%	10,094
1956	554,028,000	18%	9,777
1957	671,567,000	22%	9,373

While the company was rushing completion of its first steam-electric unit and making plans for a second and larger unit, it took steps to meet the competitive gas situation. An analysis was made of the sales problems. This showed the company should make a determined effort to hold present space heating customers and to secure new space heating load.

The heat pump offered the best vehicle to maintain and increase electric space heating load. There were a few commercial installations in the territory and these were operating successfully. Steps were taken to install additional heat pumps in the company's new office building and in homes of employees and friends.

Weather conditions in Southern Nevada proved favorable to heat pumps. Average winter temperature is about the same number of degrees below 70F that the average summer temperature is above. Average winter-month temperature during the past three years was 47F, with average daily minimum 31.1F. During the summer months average temperatures have been 86.2F and the average daily maximum 100.9F.

These temperatures require slightly more heating capacity in winter than cooling capacity in summer. Some strip resistance heating is required in winter to overcome this deficiency, and for the cycling period of the air-to-air machines. Use of resistance heating strips has not had any appreciable effect on system peaks; their kwhr consumption is only about 11% of the unit during winter months.

Electric rates here are low due to high customer usage and this is a factor in the increased heat pump sales. The average residential rate the last 12 months has been 1.19 cents per kwhr. Rates were increased April 1, 1958 so the average sale price is expected to increase to 1.25 cents. Our residential rate schedule has a 6½ mill final block for all monthly usage over 500 kwhr. Other companies have learned that sales of heat pumps at higher electric rates are feasible.

All media are utilized for publicizing the heat pump. Basically, the approach is educational, since there had been little previous heat pump advertising in the area.

The successful 1958 campaign ran principally in the May-July and November periods, emphasizing "Suddenly It's Spring" or "Meet a Happy Heat Owner" themes. Technical details were left to advertisements run by the dealers.

Annual Consumption To Top 10,000 Kwhr

Company officials confidently expect to increase residential annual average consumption considerably above the 10,000 kwhr mark in the next few years. Many of our customers use far more than this amount now, some over 5,000 kwhr in a single month. An analysis showed over 25% of all monthly residential bills issued in 1956 were for 1,000 kwhr or more and about 10% were for 2,000 kwhr or more.

During the summer and winter seasons, the percentage of high usage bills is much higher. Over 15% of customers used 3,000 kwhr or more for each of the three winter months. The moderate fall and spring climates tend to lower annual average usages.

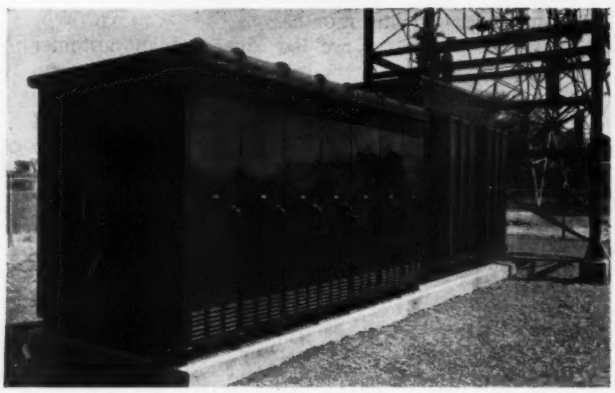
Outdoor installation of heat pumps is becoming common in the Las Vegas area. Where they do replace evaporative coolers, they generally are located on the roofs or ends of houses to tie into existing ductwork.

Zone control of temperatures on heat pumps for larger commercial installations is achieved by conveniently located thermostats which mix the air from the hot and cold ducts to give the desired temperature.

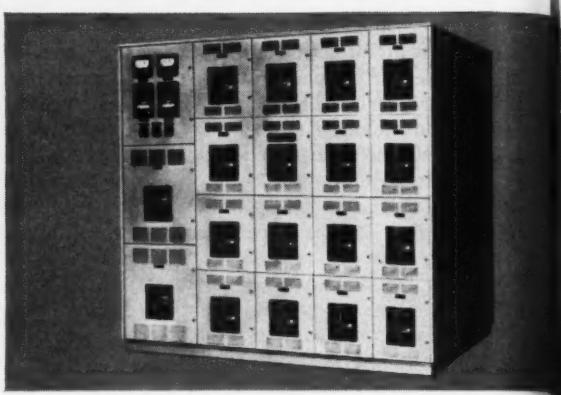
Customer satisfaction of heat pump owners is generally high, especially where customers have used other methods of space heating at higher costs. In a few cases, dealers have not expanded their service organizations as fast as their sales organizations, but this service problem is being corrected.

I-T-E CIRCUIT BREAKER COMPANY

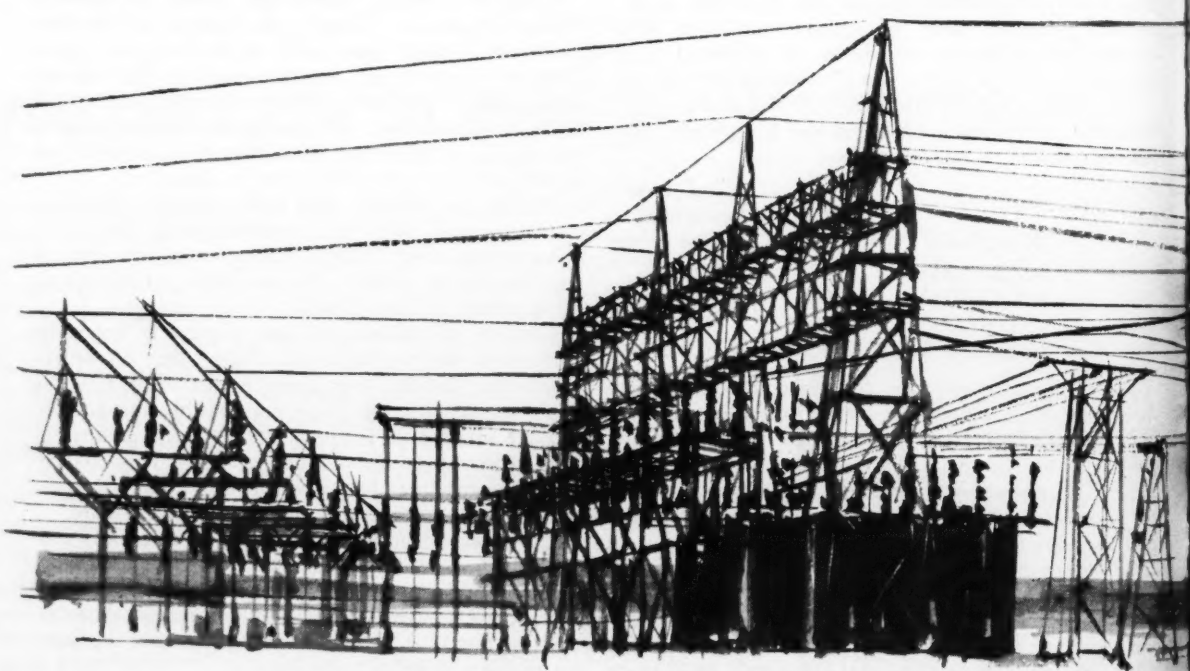
EFFICIENT



Custom designed at no extra cost. I-T-E primary unit substations are designed and built to meet your exact power, space and future expansion requirements. Transformer and switchgear sections are constructed in the same plant to assure smooth coordination of components, easier assembly, pretested performance and delivery to match your own construction schedule. Available in all standard kva ratings and secondary voltages to 13.8 kv.



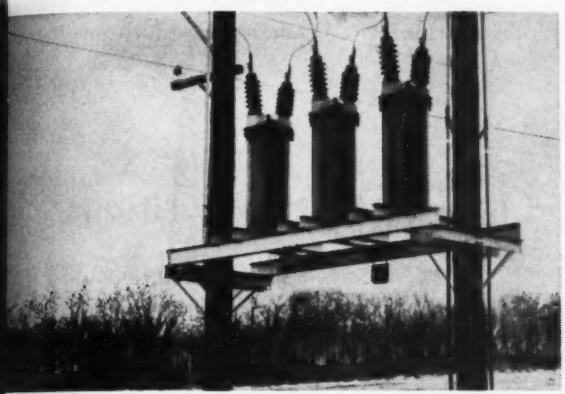
Easily adjusted for higher loads. Expanded calibration over-current trip device on I-T-E K-LINE low voltage switchgear provides maximum load flexibility and service continuity. Greater range saves costs of new trip devices. Manual quick-make closes contacts smoothly in only 5 cycles. Breaker can be moved from connected to test to disconnected position without opening door.



At I-T-E, substation structures are designed and fabricated in the same plant . . . under one responsibility. Once the single-line diagram has been prepared, engineering and manufacturing personnel closely coordinate every step of substation production—from preparation of layout drawings and application of blade switching equipment to the finished and carefully identified structural parts. You benefit from a more efficient design, more efficient use of materials, and virtually rework-free assembly at the installation site.

I-T-E's unified substation service has been meeting the needs of utilities for almost half a century. During this time it has delivered over 100 million pounds of steel substation components. And in 1947 I-T-E solved the problem of excessive maintenance due to corrosive atmospheres by producing the first all-aluminum substation.

The efficient planning and original thinking which are embodied in I-T-E substations are typical of the extra care—extra quality—found in all I-T-E products. Utility men know this from day-to-day experience with I-T-E equipment. And comparing prices shows that I-T-E quality costs no more.



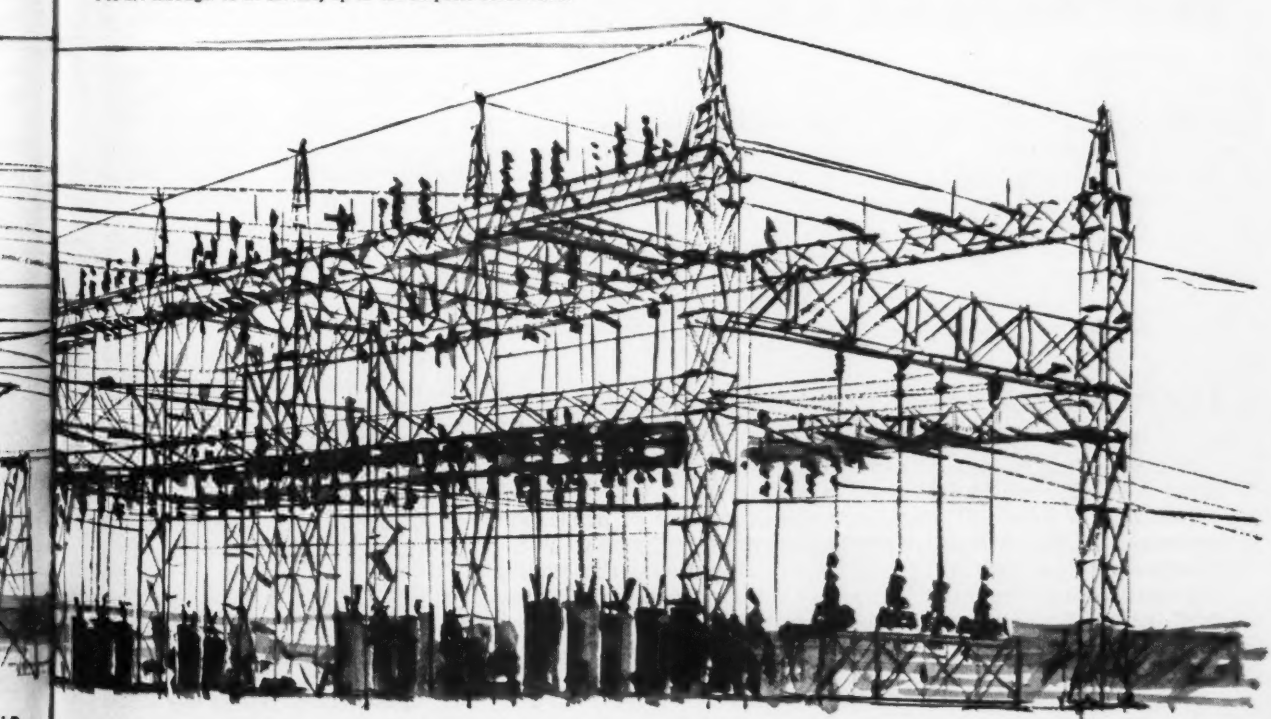
Fastest transient fault protection. I-T-E automatic circuit reclosers improve continuity of service . . . reduce lost revenue from outages. Faults are interrupted within 1½ cycles. Inverse time characteristics coordinate with fuses and protective relays to isolate persistent faults. No auxiliary power supply or control relaying is required. For 2.4 through 46 kv service, up to 400 amperes continuous.

I-T-E Circuit Breaker Company U-2
1900 Hamilton St., Philadelphia 30, Pa.

- ☐ Outdoor substation structures
- ☐ Primary unit substations
- ☐ K-LINE switchgear
- ☐ Automatic circuit reclosers
- ☐ Outdoor air switches
- ☐ Load interrupter switches
- ☐ Distribution cutouts
- ☐ Metal-clad switchgear
- ☐ Other_____

Name_____Title_____
Company_____
Street_____
City_____Zone_____State_____

SEND COUPON Get full details on specific I-T-E equipment. And remember I-T-E engineering assistance is always at your disposal.



Davis Gets Top Utility Post

J. Luther Davis (left) has been named president of Tucson Gas, Electric Light & Power Co. He succeeds J. R. Snider who has retired, but will remain as chairman of the board in a consulting capacity.

Davis, who had been executive vice president, joined the utility four years ago. After first serving as an assistant to Snider, he was named vice president in 1957.

Prior to joining the power company, Davis was assistant city attorney and city manager of Tucson. A native of Memphis, Tenn, he attended the University of Arizona and holds degrees in business administration and law.

Snider had been president of the Arizona utility for 13 years. He was formerly associated with the Federal Light & Traction Co which was the holding company of Tucson Gas until 1946.

Iowa Power & Light Names Four to New Executive Positions

THOMPSON SAYRE SLADE

Iowa Power & Light Co has made four new appointments. A. Paul Thompson has been named executive vice president; J. A. Sayre was appointed vice president; and L. E. Slade was named financial vice president and treasurer, in addition to his duties as secretary. Ralph L. Meyer, head of the Accounting Division and assistant treasurer, was promoted to controller.

Thompson joined Ipalco in 1950 as vice president and treasurer. Before that, he was with the Central National Bank of Cleveland.

Sayre has been manager of the utility's commercial department since 1956. He joined the company in 1937. He is president-elect of the Iowa Engineering Society.

Slade joined the power company in 1940 as an engineer, and was elected secretary in 1948. In 1955, he became vice president and secretary. He is also manager of the company's legal department.

Thornborrow Joins EEI Staff

John Thornborrow has been appointed director of economics and statistics of Edison Electric Institute, succeeding Walter B. Gesell.

Thornborrow joins EEI after nine years as manager of public utility investments of The Northwestern Mutual Life Insurance Co, Milwaukee.

With more than 20 years of experience in utility economics, statistics, rate matters and investments, Thornborrow has served with Central Illinois Public Service Co, Southwestern Gas & Electric Co, Middle West Service Co, The Cleveland Electric Illuminating Co, and Ebasco Services Inc.

(*More News About People page* 97)

Neoprene jacket on Anaconda cable takes impact of avalanche

This 5000-volt cable had already provided 5 years of service when a strip mine mishap buried it under tons of rock. The cable was supplying power to a giant ore stripping shovel when an overhanging section of a 90-foot cliff suddenly collapsed.

The rockslide stretched, gouged and pounded a 500-foot section of the neoprene-jacketed cable . . . but didn't knock it out. The buried cable continued to maintain service.

To protect the strong internal construction of their cable, Anaconda Wire and Cable Company use jackets of Du Pont neoprene. Installations like this prove that neoprene has the necessary resilience to prevent cutting, gouging and impact damage, and neoprene's excellent weatherability and resistance to chemicals, oil, heat, cold-weather stiffness provide *protection that lasts.*

You can be sure of long-lasting performance when you specify neoprene jacketing on wire and cable. For details, write to E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-3, Wilmington 98, Delaware.

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Westinghouse URL and URF voltage regulators give you this 3-part system...

• Instant-response tap changer

• Inverse-time relay • 1¼% steps"

This three-part arrangement provides the narrowest practical bandwidth and, hence, the best regulation for every system, under every voltage condition. Westinghouse URL and URF regulators, engineered with all practical limitations in proper perspective, combine (1) instant-response, geneva gear driven tap changing, (2) inverse-time relaying and (3) 1¼% steps.

Practical limitations on bandwidth

Theory may ignore practical limitations, but an engineer looking for peak performance cannot. For example, theory once held that very narrow bandwidths could be set because of the infinitesimal voltage changes possible with induction regulators. Experience proved otherwise, however, because system voltages do not follow a straight line trend. Closer relay band settings result in random voltage changes exceeding the band limits more frequently, causing increased regulator operations. This determines *practical* minimum bandwidth.

Reduced operations on narrow band setting

Bandwidth reduction results in more tap changer operations. For example: On a typical system, a bandwidth reduction from 3 volts to 2 volts, with no change in time-delay setting, caused increased operations for both a ⅝%-step and a 1¼%-step regulator. But even here, the 1¼%-step unit with inverse-time relay held operations to only 64% of those for the ⅝%-step regulator with 60-second fixed time delay.

For both the Westinghouse URL and URF regulators, a range of time-delay multiplier settings from 1 to 5.5 permits control of the number of tap changer operations on narrow bands—without sacrificing high-speed corrections on large voltage changes.

Unique control permits 1¼% steps on narrowest practical bandwidth

Conventional control systems using a balanced-beam type voltage relay usually require a holding voltage to minimize contact burning. This requires additional bandwidth in relay settings. The exclusive Westinghouse CVR relay requires no holding band—therefore, it is possible to set URL and URF regulators to bandwidths between 1½ and 2 volts, while retaining the advantages of 1¼% steps.

Thus, the three-part system of Westinghouse URL and URF regulators permits smaller practical bandwidths, minimum maintenance, maximum life and maximum circuit protection.

Ask your Westinghouse representative for further details on the bonus values from Westinghouse URL and URF regulators. J-70856

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

H. F. Barsun, Manager, Regulator Engineering, Westinghouse Electric Corporation, presents an engineering approach to narrow bandwidths.

Kellogg Microwave Controls Utility Operations

"Operation of these microwave channels has proven to be far superior to even the best constructed wire lines."

This is the opinion of a leading western utility company describing the overall extensive microwave system of which a 400-mile Kellogg PTM microwave network is part. With eight channels on some circuits and as many as 23 on others, the Kellogg portion includes 17 stations. There are 13 terminals, two junctions stations and two drop station repeaters.

Modern, *reliable* Kellogg Microwave is an economical, sure and convenient way to coordinate and direct such vast and complex systems as a utilities operation. This western system, for example, carries normal telephone trunks and individual telephone lines, as well as performing vital telemetering and automatic load and frequency control functions.

Today, with dual path systems, Kellogg microwave users have even more reliability at their command. With dual path, all switchover equipments or circuits are eliminated. A failure of one of the units will not interrupt traffic, hence there is no traffic time loss as a result of switching to standby.

Reliability is increased since both operating units are continuously monitored. Space or frequency diversity equipments may be added to the dual path system with a minimum of additional components.

The Kellogg Model 10C-2 PTM Microwave System now features up to 45 channel multiplexing equipments. Channels are readily arranged to suit the needs of specific installations whether for telemetering, remote control, data and voice transmission. Our engineering staff is always at your service ready to discuss your communications problems.

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CHICAGO, ILLINOIS

Kellogg Switchboard and Supply Company, 6650 South Cicero Avenue, Chicago 38, Illinois. Communications Division of International Telephone and Telegraph Corporation

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TEXAS: 1515 Turtle Creek Blvd., Dallas 7, Texas, RIverside 7-5191.
EXPORT: 157 Prospect Street, Passaic, N. J., PRescott 3-5100.

Why Kellogg PTM is Setting New Performance Standards:

Microwave has made huge strides since first pioneered by International Telephone and Telegraph Corporation in 1931. Here are 10 reasons why Kellogg's Pulse-Time Modulation Microwave, perfected by ITT research, is inherently superior.

1 Easy maintenance, particularly of the RF equipment; visual test and check methods may be used.

2 Tubes may be changed at random *without* realigning the Intermediate Frequency Amplifier.

3 Where propagation is a problem due to multi-path cancellation, it is simple to install space diversity reception equipment.

4 Drop channels may be installed at random, without need to demodulate entire groups to audio.

5 Economical system design: drop and insert channels may extend only throughout those parts of the system where required, and not the entire length.

6 Maximum transmitter tube life; tube life averages approximately 15,000 hours for 2C39s.

7 All PTM channels are interchangeable, only one spare is required.

8 High signal-to-noise ratio: the inherent noise of each channel is "clipped" out. Each terminal and each repeater station transmits a fresh signal.

9 Less tower rigidity required for accurate signal transmission at 2000 mc.

10 Plug-in channel units feature printed circuitry replacing tubes with crystal diodes; demodulators semi-passive, one tube per channel; modulators passive, no tubes. Results in 4:1 reduction in the number of tubes and 5:1 reduction in power consumption.

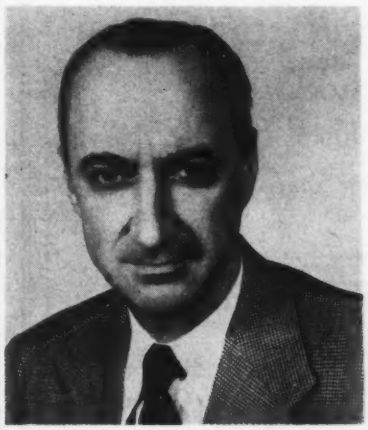
Investigate these and other advantages of a Kellogg PTM Microwave system. Write for complete details.

Chance Ups Argo to Regional VP

A. B. Chance Co has promoted Dwight E. Argo to regional vice president. In his new position, he will be in charge of all company operations in eight western states, including the Chance manufacturing plant and sales ServiCenter in San Francisco.

He succeeds J. T. Isbell who retired after 31 years.

Argo joined Chance in 1941 as a salesman. He later became senior salesman, district sales manager, and in 1954, Southwest regional manager. He was appointed Western regional manager in 1957.



Brennan Heads New American Standard Division

John W. Brennan has been named president of the newly formed Industrial Division of American Standard. He was formerly president of the American Blower Division. The new division is the result

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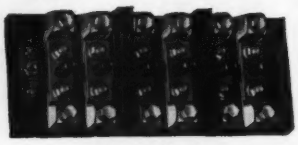
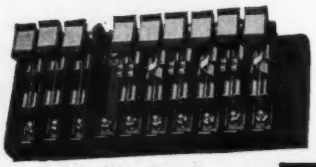


Test Block



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February 26, 1959

of the consolidation of the American Blower, Kewanee Boiler, and Ross Heat Exchanger Divisions.

Other division executives include: Richard S. Reade, vice president-manufacturing, who was formerly president of the Ross Heat Exchanger Division; Elbert M. Palmer, vice president, customer relations, formerly president of the Kewanee Boiler Division; Edwin W. Petersen, vice president, marketing; Richard L. Bernhard, vice president, engineering; Townsend Tinker, vice president, technical development; Wells A. Gardner, vice president, works manager; and Albert O'B. Andrews, vice president, controller.

Ferrante Named Tobe Deutschmann VP

Joseph F. Ferrante has been made vice president of Tobe Deutschmann Corp.

Although only 34, Ferrante has been active in every phase of the company's operation. In his nine years with the firm, he has worked principally in the design and development of capacitors for thermonuclear research. One application of his work in this field is "Scylla," a hydrogen fusion device unveiled recently at Geneva which uses capacitors designed by him.

PERSONAL BRIEFS

Harold A. McLaughlin has been appointed director of engineering research for Central Hudson Gas & Electric Corp. **Charles A. Bolz,**

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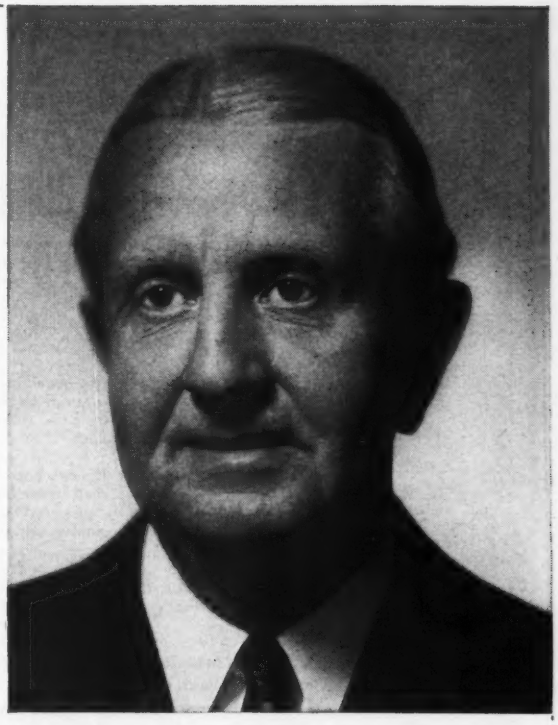

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HA-1

Jr., has been made design division manager, and **Mitchell S. Kozik** was named assistant to the director of engineering research.

J. Lee Ranney has been appointed right of way supervisor for Central Illinois Light Co.

Ohio Edison Co has named **Andrew Carnegie** to handle special operating assignments and **E. F. Dissmeyer** in charge of production-transmission.

Edward S. Baumgardner has become superintendent of transmission and distribution in the Bay division of the Ohio Edison Co. **Kenneth L. Group** has succeeded him as supervisor of the Springfield Division Line Department.

Vernon G. Thompson has been named New Mexico Division sales manager for Community Public Service Co, succeeding **G. W. Sherwood** who has retired.

J. Irving Kibbe has been named secretary of Public Service Electric & Gas Co.

Charles A. Miller has been named manager of the Rural Division of the Omaha Public Power District. He succeeds **Harry A. Smith,** who retired.

Donald L. Jordin has been named to fill the newly created post of agricultural engineer at Washington Water Power Co. He was formerly farm sales supervisor.

Public Service Electric & Gas Co has named **Warren A. Knight** director of publicity.

William M. Shepherd, vice president of Arkansas Power & Light Co has been named a member of the U. S. Trade Mission to Calcutta, India from Feb. 14 to April 18.

Bob Scott has been named to succeed **Alex Manson** as assistant general sales manager of British Columbia Electric Co.

The following promotions have been made in the Trenton Electric Distribution Dept, Southern Division, of Public Service Electric & Gas Co: **Warren E. Beck** to engineer; **John E. Cashel** to assistant engineer.

Manufacturers Literature

To request literature, use code numbers indicated for each item when filling in Reader Service form on page 80.

CIRCUIT BREAKERS . . . and enclosures. Pocket-sized 31-page catalog on all products available from distributor stocks. Stab-lok circuit breakers and enclosures, STABreakers and enclosures, AB-I molded case circuit breakers, panelboards, fusible service equipment, safety switches, industrial motor control, lighting and power panelboards. Stab-lok enclosure selector included. Federalog No. 111-PR Federal Pacific Electric Co, Dept. 303, 50 Parris St, Newark 1, N. J. F1

STATION ARRESTERS . . . 60 to 276 kv, Form 3K Thyrite, magne-valve, for high voltage and extra-high voltage applications. Bulletin No. GEA-6794, 12 pages. General Electric Co, Schenectady 5, N. Y. F2

IMPULSE TESTING . . . of Delta-Star distribution transformers. Technical information, 4-page brochure. Delta-Star Electric Div, H. K. Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill. F3

MAGNETIC AMPLIFIERS . . . Systems for nuclear reactor installations. Complete with photos and charts, describes rod programmer amplifiers designed for Shippingport nuclear power plant. Servo drives and applications in nuclear drive systems, also Stat-Pack static magnetic switching systems for reactor control circuits, programming and simulators. Bulletin S-963, 8 pages. Magnetic Amplifiers, Inc, 632 Tinton Ave., New York 55, N. Y. F4

DATA-PROCESSING SYSTEM . . . Univac II, magnetic-core memory system, with access to 24,000 alphabetic or numeric characters. Handles either Univac I or Univac II programs. Folder, 6 pages. F5

DATA-AUTOMATION SYSTEMS . . . functions of punched cards, perforated paper tape, and magnetic type thoroughly described, well illustrated, 24 pages. F6

Above publications F5 and F6 issued by Remington Rand, Div of Sperry Rand Corp, 315 Fourth Ave, New York 10, N. Y.

MAGNETIC STARTERS . . . ac, in NEMA sizes 0 through 4 for both reversing and non-reversing single phase and squirrel cage motors. Magnet coils, overload relays, contact, assembly, enclosure types. Pub. No. EN-150. Cutler-Hammer, Inc, 235 N. 12 St, Milwaukee 1, Wis. F7

SILICONES . . . 1959 guide, indexed for entire line ranging from adhesives to release agents, resins to rubbers, dielectrics to water repellents. Dow Corning Corp, Midland, Mich. F8

PLASTICIZER . . . Peroxidol 781, epoxidized ester plasticizer offers low temperature flexiblity, low plastisol viscosity. Reichhold Chemicals, Inc, RCI Bldg, White Plains, N. Y. F9

ADHESIVES . . . coatings, sealers with good heat resistance and bond strength. From 300-500 psi and more shear strength. Applications illustrated. Adhesives, Coatings & Sealers Div, Minnesota Mining & Mfg Co, 900 Bush Ave, St, Paul 6, Minn. F10

TUBING . . . PTFE (polytetrafluoroethylene) with dielectric properties over wide temperature and frequency range. Irvington Div of Minnesota Mining and Mfg Co, (3M), 900 Bush Ave, St. Paul 6, Minn. F11

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS has issued the following publications: 1F—Guide for Statistical Analysis of Test Data, no charge; 76—Guide for Maintenance Transformer Askarel, no charge; 504—Test Code for Carbon Brushes, 80¢; 606—Recommended Specification for Speed Governing of Internal Combustion Engine-Generator Units, $1.00; C37.4a—Electrical Characteristics and Dimensions of Power Circuit Breaker Bushings, Their Mountings and Bushing Current Transformers, 35¢; C37.11—Power Circuit Breaker Control, 80¢; C37.16—Schedule of Preferred Ratings for Alternating- and Direct-Current Low-Voltage Air Circuit Breakers, 40¢; C57.12.00—Transformers—General (Section 00), $2.00; C57.12.10—Transformers, 67,000 Volts and Below, 501 through 10,000 kva, 3 Phase; 501 through 5,000 kva, 1 Phase (Section 10), $1.50; C57.12.20—Overhead-Type Distribution Transformers. 67,000 Volts and Below, 500 kva and Smaller (Section 20), $2.20; C57.12.30 — Three-Phase Load-Tap-Changing Transformers, 67,000 Volts and Below, 1,000 kva through 10,000 kva (Section 30), $1.50; C57.12.80—Transformers—Terminology (Section 80), $1.00; C57.12.90—Transformers—Test Code (Section 90), $2.20; C57.16—American Standard Requirements, Terminology, and Test Code for Current-Limiting Reactors, $2.00; C57.93—Guide for Installation and Maintenance of Oil-Immersed Transformers, 75¢; C57.94—Guide for Installation and Maintenance of Dry-Type Transformers, 50¢; C89.1—Requirements and Terminology for Specialty Transformers, $3.00. AIEE members may obtain all above-listed publications at 50% discount except C37.4a, which is 20¢ per copy and C57.93, which is 75¢ per copy to members. AIEE, 33 W 39 St, N.Y.C. Specify above-listed AIEE publication Nos., also give Code No. F12

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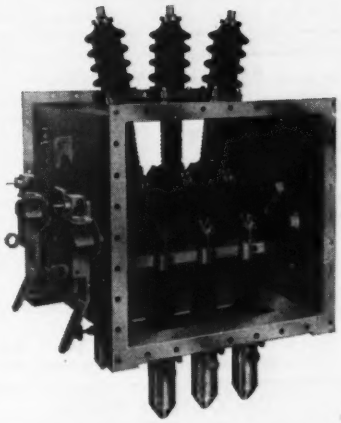

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Mount Vernon, N. Y. MO 4-7117 | Norristown, Pa. Broadway 9-3000

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

DISPLAYED RATE:

EMPLOYMENT OPPORTUNITIES: $22.67 per inch. Subject to Agency Commission.

EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

UNDISPLAYED RATE:

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals)

SEND NEW ADVERTISEMENTS TO Classified Advertising Div. of ELECTRICAL WORLD, P. O. Box 12, N. Y. 36, N. Y.

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	1667	Mol.	69,000–34,500
3	833	West.	66,000–6900/11950
3	500	G.E.	66,000/33,000–2300/13200
3	500	Wagner	69,000–460
4	333	West.	67,000–7200
1	2500	Mol.	44,000–2400/4160, 3 Ph.
2	2500	Wagner	45,800/22,900–4160Y, 3 Ph.
3	500	G.E.	44,000–2400/4160
3	200	West.	44,000–480
1	5000	West.	34,500–13750/6875, 3 Ph.
1	3750	G.E.	34,400–13800/7960, 3 Ph.
2	3000	Upgl.	34,750–4160, 3 Ph.
2	1500	G.E.	34,400–2520, 3 Ph.
3	1000	A.C.	34,650/11,500–2300
3	500	Mol.	34,500–2300/4600
4	333	G.E.	34,650–7200/12470Y
3	200	A.C.	34,500–2400/7200/12470/Y
2	1500	G.E.	23,000–2400/4800, 3 Ph.
1	7500	A.C.	13,800–2400, 3 Ph.
3	1667	G.E.	13,800–600
3	667	Kuhl.	13,800–480
1	600	Stand.	13,200–2300, 3 Ph.
1	450	Penna.	13,000–2400, 3 Ph. Askarel
1	4500	West.	7200–2400, 3 Ph.
3	333	Mol.	7200/12470–2400/4160
3	100	G.E.	7200/12470–240/480
3	125	A.C.	6900–2300
3	100	G.E.	4800–120/240
3	400	G.E.	2300/4000–230/460
3	100	G.E.	2300/4000–230/460

FEEDER REGULATORS—OUTDOOR

1	750	G.E.	360 A. 12000 V. 3 Ph STEP
1	500	G.E.	694 A. 4160 V. 3 Ph STEP
1	375	G.E.	50.2A. 34500 V. 3 Ph STEP
1	250	A.C.	601 A. 2400 V. 3 Ph STEP
3	96	G.E.	200/400 A., 2400 V. 1 Ph IND
8	36	West.	150/300 A., 2400 V. 1 Ph IND

Also: FREQ. CHGRS., M-G SETS, SYN. CONDENSERS, OIL CIR. BRKRS., ETC.

BREW, WOLTMAN & CO., INC.

52 Church Street New York 7, N. Y.

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—for you—the advertiser—and the publisher, if you mention this publication. Advertisers value highly this evidence of the publication you read. Satisfied advertisers enable the publishers to secure more advertisers and—more advertisers mean more opportunities or better service—more value—to YOU.

PUBLIC UTILITY RATE MAN

Excellent opportunity with consulting firm. Prefer age 35-45, college graduate, E.E. degree, with electric and/or gas utility experience. State regulatory commission experience would help. Must possess personality and ability to deal with client customers at top management level. Salary depends upon age, experience, previous earnings and capacity. Job requires travel. Send complete resume with photograph to P. J. Fallon, Middle West Service Company, Consulting Management Engineers, 20 North Wacker Drive, Chicago 6, Illinois.

DESIGN ENGINEER

To perform creative work in design and development programs on high voltage power circuit protective devices. ME or EE graduate with minimum of 3 to 5 years experience. Growth opportunity. Chicago location. Send complete resume in confidence with salary requirements to:

P-1030 Electrical World
520 W. Michigan Ave., Chicago 11, Ill.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Assistant or Associate Professor to develop a curriculum in Electrical Engineering and eventually be chairman, in a private Engineering School in Northern California College. Send detailed resume, references, recent photo. State salary. P-9986, Electrical World.

Electrical Engineers Wanted—Several openings for graduate electrical engineers in engineering development work for semi-conductors and for heavy chemicals. Work involves design of control systems, plant assistance and evaluation work. Three to five years experience required in electrical engineering work. Good opportunity for growth and advancement. Midwest location. Salary depending on qualifications. P-1118, Electrical World.

SELLING OPPORTUNITY OFFERED

Manufacturer of substation equipment interested in securing live wire representative in the state of Ohio. RW-1098, Electrical World.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5164) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, April 28, 1959, for furnishing two, 230-Kv., 1,200-ampere, 5,000,000-Kva. and one, 115-Kv., 1,200-ampere, 3,500,000-Kva. power circuit breakers for Huron Substation, Missouri River Basin Project, South Dakota. Delivery is desired within 420 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 25, Colorado. W. E. Dexheimer, Commissioner.

TRANSFORMERS

4—2500 KVA W-H 38000/66000Y-2400/4800/11000

3—500 KVA W-H 13200-2300/4000Y

3—500 KVA W-H 7200-2400/4160Y

3—400 KVA W-H 11500-2400/4800

3—333 KVA W-H 67000-480

3—333 KVA W-H 2400-120/208Y

6—167 KVA G-E 7200-2400/4160Y

6—150 KVA G-E 7200-240/480

1—750/938 KVA G-E 3-Ph. 33000-6900Y TCUL equip. fan cooling

1—1000 KVA W-H 3-Ph. 33000-7200Y TCUL equip.

1—2000 KVA W-H 3-Ph. 13800-2400

1—1500 KVA W-H 3-Ph. 13200-480

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5331 HETZEL STREET
CINCINNATI 27, OHIO

45 Years' Dependable Service

MOTORS • GENERATORS TRANSFORMERS
NEW & REBUILT
ELECTRIC EQUIPMENT CO.
WORLD'S LARGEST INVENTORY
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P. O. BOX 51 • ROCHESTER 1, N. Y.

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Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

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Electrical Equipment Representatives

Write for copy of EERA Directory
C. W. SWARD, Executive Director EERA
1675 Fifth St. Clermont, Florida

OPPORTUNITY FOR REPRESENTATIVES
Established Manufacturer of Transformers—10,000 KVA, 115 KV and below—Oil, Askarel and Dry Types—interested in contacting aggressive manufacturers' representatives for representation in the following territories:
New England States, Indiana, Kentucky, Iowa, Kansas, Missouri, Oklahoma, Western Tennessee & Arkansas, State of Washington, Colorado
RW-1078, Electrical World
Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

The Meetings Calendar

MARCH

• **Electronic Representatives Association**—First General Meeting, Coliseum, New York City, March 23.

Southeastern Electric Exchange—Annual Conference, Boca Raton Hotel, Boca Raton, Fla., March 23-25.

Canadian Electrical Association — Western Zone Meetings, Royal Alexandria Hotel, Winnipeg, Man., Canada, March 23-25.

Institute of Radio Engineers—National Convention, Coliseum and Waldorf Astoria, New York City, March 23-26.

Institute of Printed Circuits—Second Annual Meeting, New York City, March 24-25.

• **National Electrical Manufacturers Association** — General Engineering Committee, Precision Snap-Acting Switch Group, Industrial Control Section, NEMA Office, March 24-25.

Fifth Biennial Chicago Electrical Industry Show — Sponsored by the Electric Association of Chicago, Hotel Sherman, Chicago, Ill., March 24-26.

Oklahoma Utilities Association—Accounting Section, Mayo Hotel, Tulsa, Okla., March 25; Annual Convention, Mayo Hotel, Tulsa, Okla., March 26-27.

Pacific Coast Electrical Association—Engineering and Operating Conference, Hotel Lafayette, Long Beach, Calif., March 30-31.

American Power Conference—Sponsored by Illinois Institute of Technology, Hotel Sherman, Chicago, Ill., March 31-April 2.

Polytechnic Institute of Brooklyn's International Symposia—Auditorium of the Engineering Societies Building, 33 West 39 Street, New York City, March 31-April 2.

APRIL

American Institute of Electrical Engineers — Textile Subcommittee Annual Conference on Electrical Applications in the Textile Industry, Heart of Atlanta Motel, Atlanta, Ga., April 2-3; Southern District Meeting, Dinkler Plaza Hotel, Atlanta, Ga., April 8-10; 4th Biennial Conference on Electric Heating, Bellevue-Stratford Hotel, Philadelphia, Pa., April 14-15; East Central District Meeting, Sheraton-Mayflower Hotel, Akron, Ohio, April 22-24; North Eastern District Meeting, Hotel Syracuse, Syracuse, New York, April 29-May 1.

Seventh Northwest Conference on Quality Control—Sponsored by the Portland Chapter of American Society for Quality Control, Oregon Museum of Science and Industry, Portland, Oregon, April 3-4.

• **Southwest Electric Conference**—San Marcos Hotel, Chandler, Ariz., April 5-7.

Fifth Nuclear Congress—Sponsored by Engineers Joint Council, Public Auditorium, Cleveland, Ohio, April 5-10.

Edison Electric Institute — 27th Annual Convention, Hotel Roosevelt, New Orleans, La., April 6-8; EEI-AGA 18th Annual Conference on Operation of Public Utility Motor Vehicles, Netherland Hilton Hotel, Cincinnati, Ohio, April 6-9; EEI-AGA National Conference of Electric and Gas Accountants, Sherman Hotel, Chicago, Ill., April 20-22; Meter and Service Committee, Chase Hotel, St. Louis, Mo., April 27-29.

• **Rural Electric Generating Cooperative**—Tenth Annual Operating Conference, Hilton Hotel, Albuquerque, New Mexico, April 6-9.

• **American Welding Society**—Annual Meeting, Hotel Sherman, Chicago, Ill., April 6-10.

• **Building Research Institute** — 8th Annual Meeting, Penn-Sheraton, Hotel, Pittsburgh, Pa., April 7-8.

Pacific Coast Electrical Association — Administrative Services Conference, Hotel Lafayette, Long Beach, Calif., April 8-9.

• **Pennsylvania Electric Association** — Meter Committee, George Washington Motor Lodge, Pa., Valley Forge, April 9-10; Communications Committee, April 23-24; Transmission & Distribution Committee, Pocono Manor Inn, Pocono Manor, Pa., April 30-May 1.

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